Tappi

PUBLISHED BY THE TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY

MARCH 1954

VOLUME 37 • NUMBER 3

MILLS ARE IMPROVING QUALITY BY SELECTIVE USE OF DEFOAMERS

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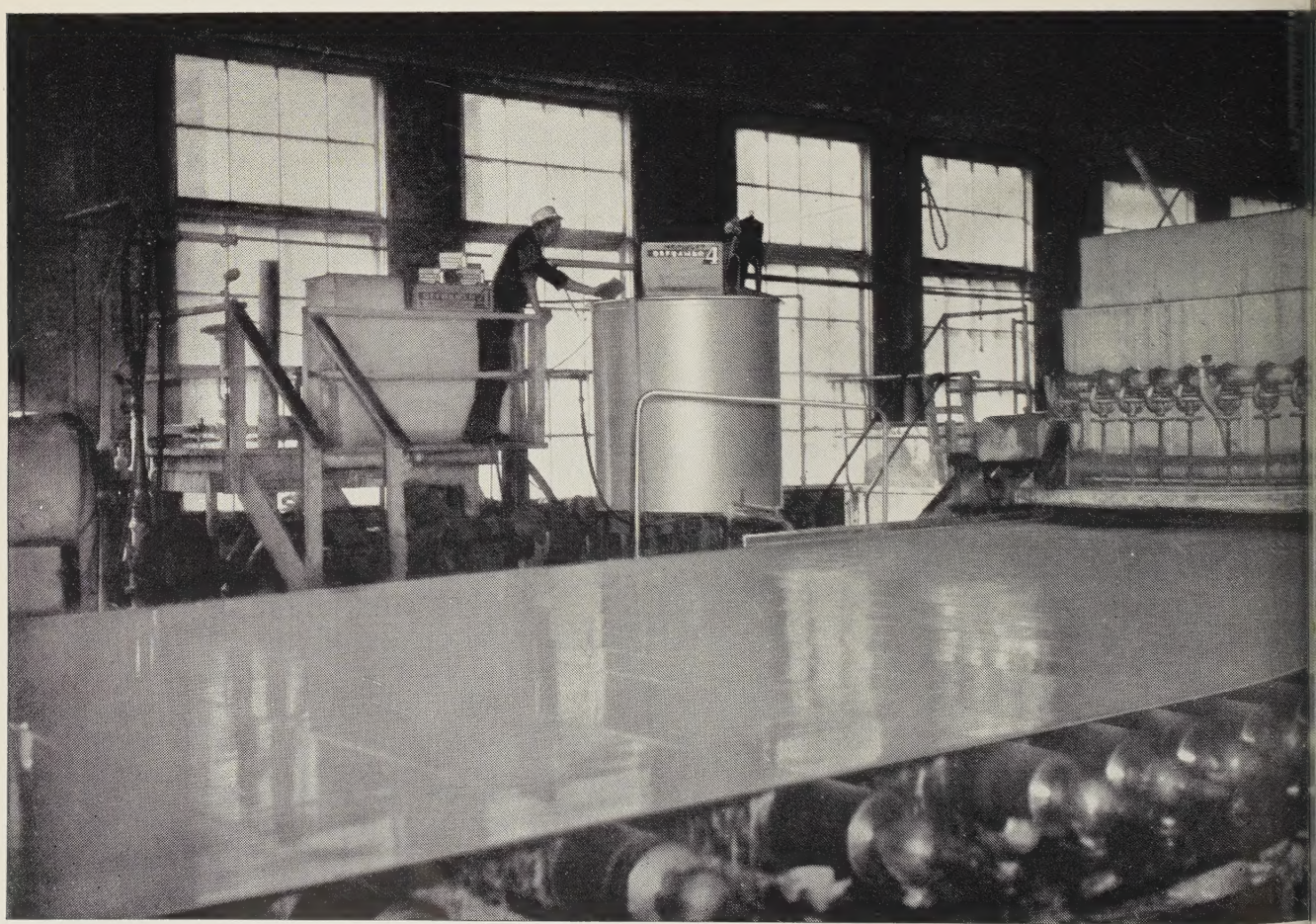

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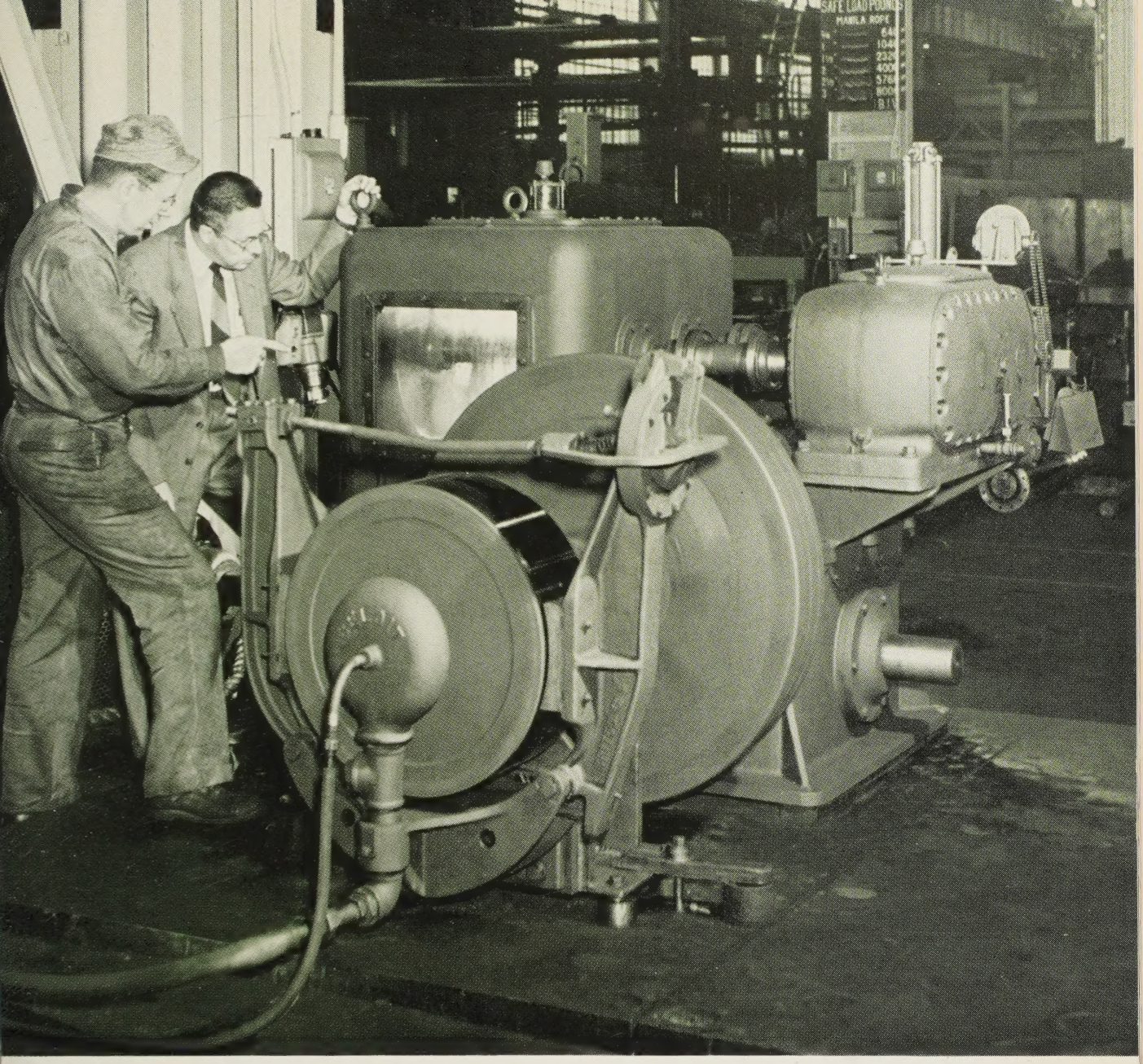

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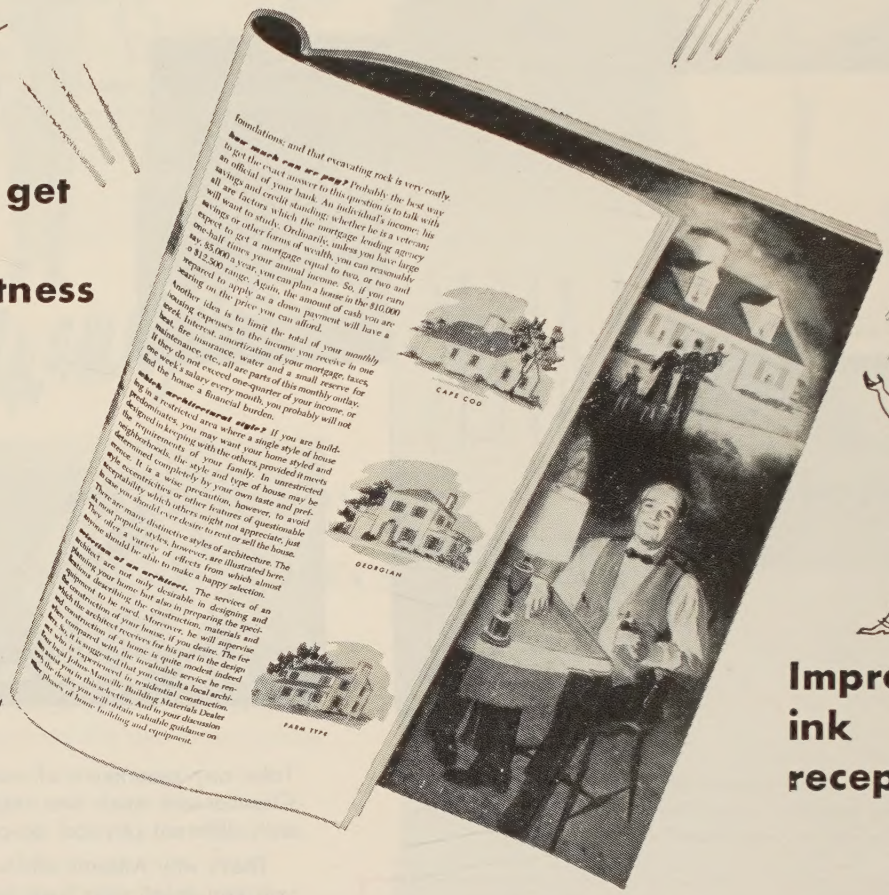

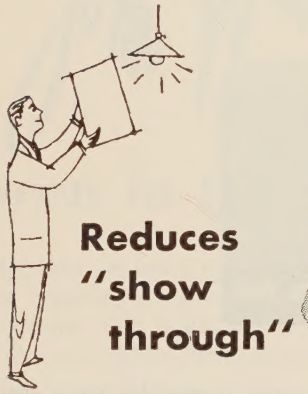

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FOR THE PAPER INDUSTRY

MARCH 1954

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TECHNICAL ARTICLES

Electric Wire and Cable Recommendations for the Pulp and Paper Industry, *by A. O. Mortenson* 81

Brown Stock Washing Efficiency. Displacement Ratio Method of Determination, *by J. K. Perkins, H. S. Welsh, and J. H. Mappus* 83

Influence of Fiberizing Variables in Producing Semichemical Pulp, *by F. A. Aflenzer* 90

Influence of Heavy Beating of Cotton Fibers on Molecule Length and Crystallinity, *by C. F. Wijnman* 96

The Chemical Composition of Some Leaf and Bast Fibers, *by E C. Lathrop and G. H. Nelson* 99

Phase Contrast Microscopy of Beaten Pulp, *by G. Van Nederveen and J. Isings* .. 103

Application of a Differential Drive to Paper Machines, *by E. S. Skinner* 109

A Pulpwood Flume System, *by J. R. Fielding* 113

Safety Evaluation and Protection of Digesters, *by H. M. Canavan and W. B. Parker* 115

A New Paper Machine Drying Control System, *by J. M. McAlear* 121

Wash Water and Wash Water Heating, *by M. Kline and J. M. Ralsion* 124

DEPARTMENTS

The Technical Man in the Pulp and Paper Industry, *by G. H. Pringle* ..... 10 A
The Tasks Ahead of Us, *by George Olmsted, Jr.* ..... 22 A
The Pulp and Paper Industry in the Far East, *by R. A. Packard* ..... 38 A
Association News and Events ..... 73 A
Personal Mention ..... 100 A
Obituaries ..... 130 A
Recent Books ..... 131 A
Divisions and Committees ..... 132 A
Local Sections ..... 136 A
Start-up Problems at a New Kraft Mill, *by K. Chapman* ..... 136 A
Mill Control of Beating and Refining, *by James d'A. Clark* ..... 140 A
Efficient Use of Dyes in Paper, *by E. P. McGinn* ..... 146 A
Employment Service ..... 151 A
Letters to the Editor ..... 152 A
Cathodic Protection for the Prevention of Corrosion in Equipment for Treatment of White Water, *by F. S. LeFebvre* ..... 152 A
Conversion to the Ammonium Bisulphite Pulping Process, *by G. A. Crowe* ..... 154 A
High Yield Pulping—An Estimate of the Future, *by C. W. Converse* ..... 156 A
Conservation of Water in the Kraft Pulp and Paper Industry, *by H. W. Gehm and W. A. Moggio* ..... 158 A
The Application of Noncorrosive Materials, *by G. R. Lydick* ..... 162 A
TAPPI Standards
Sealing Strength of Paraffin Wax. TAPPI Suggested Method T 642 sm-54 ..... 165 A
Calendar of TAPPI Meetings ..... 167 A

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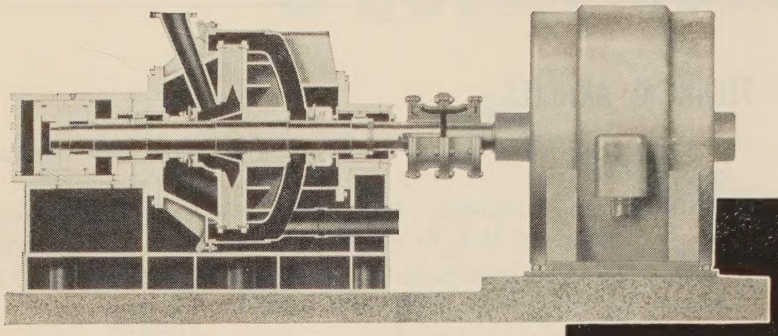
ANOTHER BAUER FIRST...



Bauer

"PUMP-THROUGH" STOCK REFINER

The Bauer No. 440 is an entirely new kind of pulp refiner. Retention time of the stock between the refining discs is controlled by a valving system in the discharge line. Specific kinds of stock treatment can be effected with various plate designs which are made without the limitations of controlling flow.

Normally the stock is pumped into the Refiner, but gravity feed can also be accommodated. The refined stock leaves the machine under a positive pressure, eliminating the necessity of stock chests and auxiliary pumps.

The operation of the No. 440 Refiner is simple indeed. Flow is regulated by a meter, and disc clearance is set automatically by hydraulic pressure. Motor loading is finger-tip controlled. This is a new and unique concept of stock preparation. Patents have been applied for.

Production has been started on the No. 440 machine with 44-inch diameter discs, which is suitable for operations up to 750 hp. Inexpensive and replaceable plates of a modified Ni-Hard Alloy are standard, but Bauer X-Alloy (stainless iron) or stainless steel plates are available.

Printed literature is not yet available, but you are invited to contact our sales engineers or to write or call directly to Springfield for more detailed information on this new Refiner or other items in Bauer's complete new line of integrated pulp plant equipment.

THE BAUER BROS. CO.

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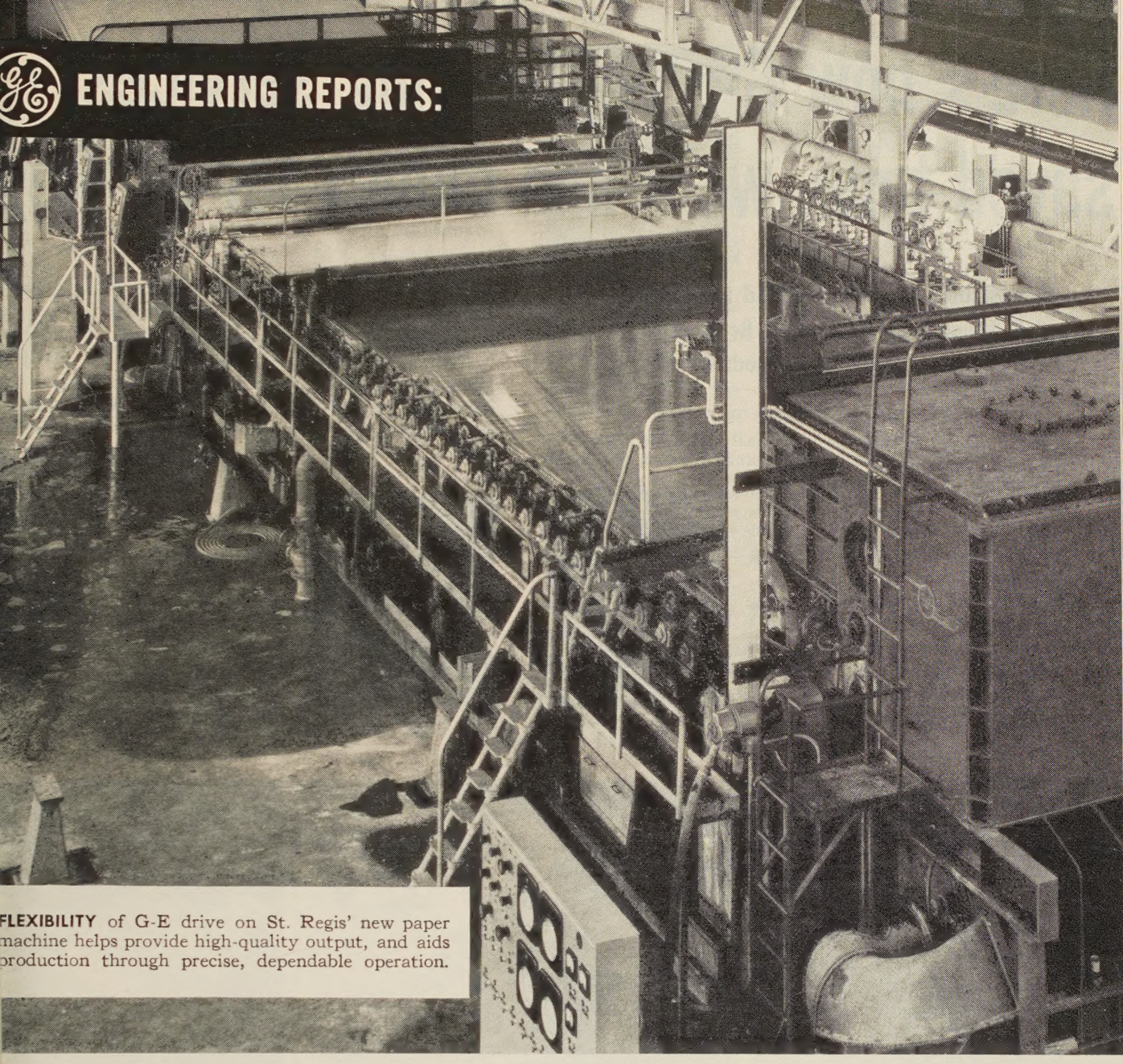
ENGINEERING REPORTS:



FLEXIBILITY of G-E drive on St. Regis' new paper machine helps provide high-quality output, and aids production through precise, dependable operation.

St. Regis' new 230-in. Beloit, powered by G-E sectional drive, produces . . .

300 tons of paper per day

Since 1945, demand for kraft paper has skyrocketed. Bidding for a bigger share of the expanding market, the St. Regis Paper Co. is depending on this giant Beloit fourdrinier machine located at their new, full-integrated mill at Jacksonville, Fla. Already, it has produced over 100,000 tons of kraft.

In operation only a year, the new machine has shown its versatility by turning out everything from 14-pound paper to 24-point board, to a wide variety of specifications. Operating speeds have exceeded 900 feet per minute.

Modern drive system—Paper machine flexibility makes top-speed output like this possible at the Jacksonville plant. It is also the reason why paper and board uniformity and quality can be kept high, even with broad product diversification.

To provide the machine flexibility they needed, St. Regis had a modern General Electric multiple-generator sectional drive installed on their fourdrinier machine. With this electronically controlled system, machine operators can hold paper speeds and tensions precisely over a wide range of settings—and turn out a high rate of top-quality production, with minimum downtime.

Electrically co-ordinated—This machine is part of a completely integrated mill. The electrical system was engineered as a unit, from wood-yard to finishing room by a team of G-E specialists working with the customers' staff and consulting engineers.

The next two pages show you a picture-story of what they did.

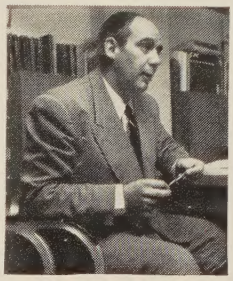
How G-E engineering teamwork helped plan a better mill

GENERAL ELECTRIC

Here's how G-E engineering services saved time, work and money for St. Reg

Co-ordinated manufacture and installation of G-E equipment helped St. Regis build one of the country's most modern mills.

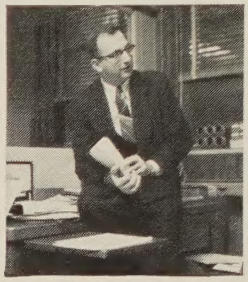
Co-ordination made a success out of the electrical system at St. Regis' new kraft mill at Jacksonville. It simplified the earliest conferences, smoothed out equipment planning and installation, helped meet start-up dates. Through co-ordination, a team of General Electric engineering specialists were able to help St. Regis and the consulting engineers design the entire mill's electrical system as a unit. It was a big job—but it saved time, money, and engineering man-hours for St. Regis.



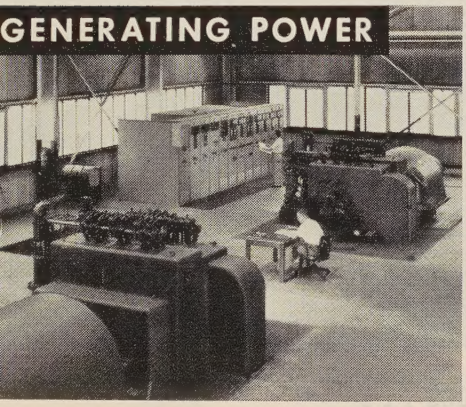
G-E Power Engineer

Engineering help started early—Sales and applicatio engineers on the G-E team were asked, in the plan ning stage, to make recommendations for the entir system. They conferred with St. Regis plant en gineers, and later, worked closely with their con sultants, Alvin H. Johnson & Co. Engineers, and wit representatives from prime contractor.

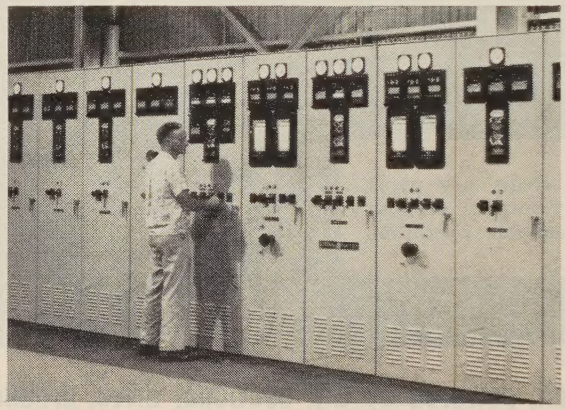
G-E "team" follows through—The rest of the G-E engineering team was calle into action. The project co ordinator at Schenectady, N. Y responsible for engineering, pro duction, and shipment co-ordi nation, scheduled the construc tion and shipping dates of a apparatus. G-E product specia ists helped work out the de tailed designs needed for specia equipment. Because of this, St



G-E Application Engineer

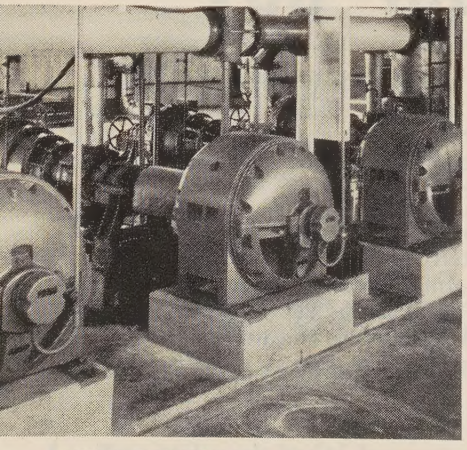


1 **POWER** for entire mill is generated by two 6000-kw G-E turbine-generators from available process steam.

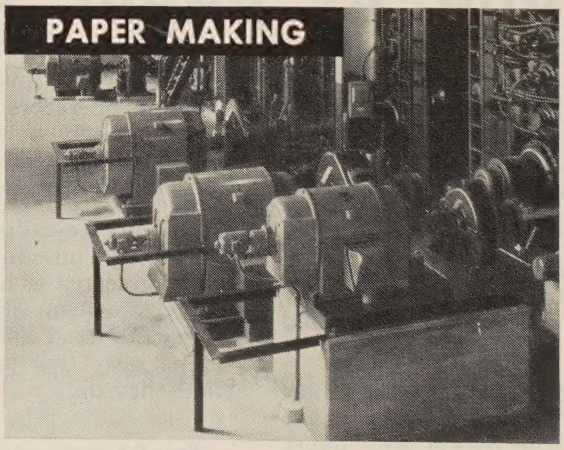


2 **FACTORY ASSEMBLY** of this turbine room 4160-V G-E switchgear helped cut installation costs

3 **RUGGED** G-E motors drive 45-ft. barking drums helping to k raw material movement high.



7 **HIGH EFFICIENCY** at low cost is provided by G-E 400-hp synchronous motors powering Jordans.



8 **FLEXIBLE** sectional drive for paper machine is all G-E powered, helps assure greater production continuity.

9 **CONVENIENT, COMPACT** control for wet end of 230-in. pa machine is located in one ro

egis engineers and the consultants were relieved of great deal of time-consuming correspondence and etails, allowing them more time for the larger aspects the project. Orders went out from Schenectady to ey G-E plants throughout the country—to Fort Vayne, Indiana; to Pittsfield and West Lynn in Massachusetts; to Philadelphia and San Jose, Calif.

Co-ordination was just as vital during equipment onstruction as it was during first planning. It aid off the same way. For instance, the construction operator's control panels for the paper machine as carried out in Wisconsin near the machine uilder to assure integrated control of the machine.

art-up aided by co-ordinated service—Deliveries Jacksonville were rigidly scheduled. Equipment rrived on site at St. Regis when needed for actual onstruction. Progress reports, issued at frequent ntervals by the G-E team, kept St. Regis' receiving, perating, accounting and expediting personnel up date.

G-E Sales Enginee·

On hand during equipment installation, G-E field engineers were able to simplify the job of getting the new mill into production. They passed operating and maintenance information on to plant personnel. And at start-up time, their services helped St. Regis go into full-scale operation. The new Jacksonville mill made its first sheet of paper December 31, 1952. The dependable G-E electrical system, controlling 25,985 horsepower, has been giving St. Regis top performance ever since. 655-15

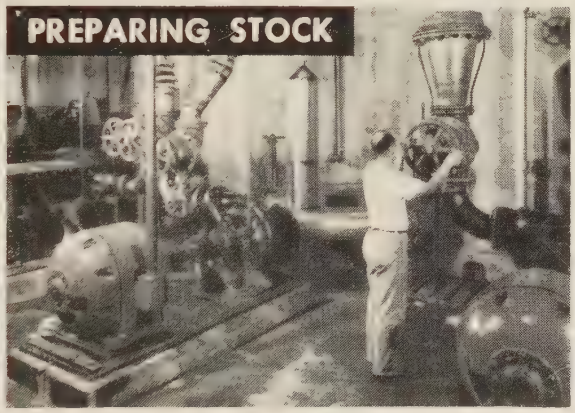
YOU CAN GET THE SAME HELP

Your job of getting a new or a modernized mill completed on time can be simplified. Call in your local G-E Sales Representatives early in your plans. Let him give you the complete story on the way a G-E Apparatus Sales Division team can work with your plant and consulting engineers to expedite your new project. General Electric Company, Schenectady 5, N.Y.

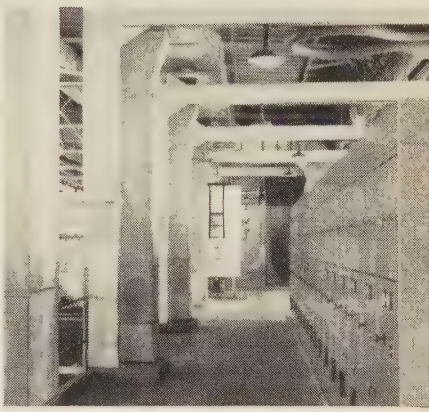
Engineered Electrical Systems for Paper Mills

GENERAL ELECTRIC

LIABLE G-E motors driving 88-10-knife chippers help reduce logs 5/8 in. chips quickly.

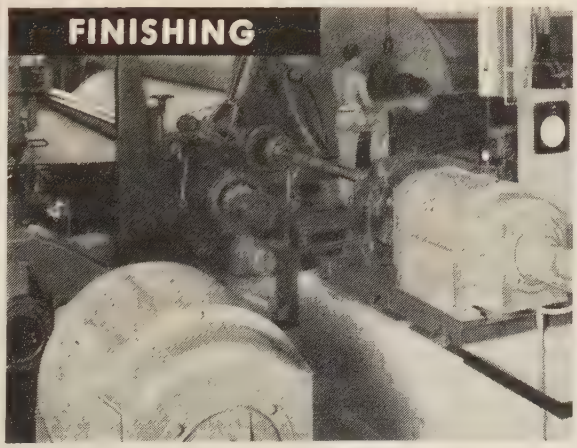


5 CONSTANT STOCK FLOW is responsibility of G-E pump motors located below paper machine room.

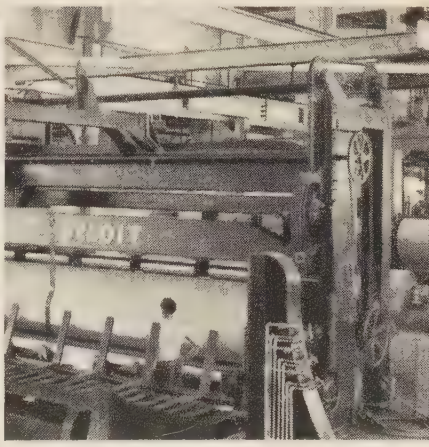


6 FOR MORE ROOM in work area, G-E limitamp control is located out of the way on this balcony

ECISE CONTROL from G-E operator's console means increased output quality kraft at St. Regis mill.



11 EASY THREADING, higher winding speeds are possible with G-E motors and amplidyne control.



12 FAST ACCELERATION, deceleration provided by G-E motor helps increase slitter and rewinder output.

THE TECHNICAL MAN IN THE PULP AND PAPER INDUSTRY

GEORGE H. PRINGLE

I BELIEVE the President of TAPPI should choose as a subject for his annual address one in which he is vitally interested. For this reason, I have selected "The Technical Man in the Pulp and Paper Industry" for my talk. This is a subject that I feel should be of real interest to all members of TAPPI.

Twenty-five years or so ago, if you went through a paper mill looking for its technical men, where would you have found them? The chances are that they would not be found in the front office. And they would not be found in the office of the superintendent either, nor among the tour bosses or foremen. No, at that time the top technical men in the industry were heading up the engineering and technical service departments. If you'd kept on looking, you'd have found a number of younger technical men who had recently entered the industry, working primarily in drafting rooms and labs. (I'm rather sure of this, because that's just about the time I came into the paper industry, and you might have seen me at one of those drafting boards.)

But go through a paper mill on the same quest today; the technical men are no longer confined to the "technical" fields. You'll probably meet one seated behind the president's desk. You'll find another in the vice-president's office. They are the mill managers, production managers, and department heads of the company. Moreover, there is an increasing number starting in and pervading the lower ranks of management.

Naturally, with so many more technical men to be found throughout the industry, the effect of their point of view on the way the industry thinks is a striking corollary. Engineering thought pervades the viewpoint of the paper industry today, and is becoming dominant.

This is a remarkable change, only 25 years ago technical men were as scarce as shives in a beater; today they hold many positions of influence and power. What has brought it about?

I think there are two main reasons for the emergence of the technical man in the paper industry. First of all, there's the mechanization and speed-up of the industry, itself, a development necessitating the employment of men trained to introduce and to deal with the modern paper machines with their complexities. Also, there's the realization by top management that technical training provides a good background in top operating, administrative, and strictly technical positions.

When the technical man has reached a high position in management in the industry, certain steps are necessary to maintain it. We older technical men must realize this fact and exert ourselves to hold these gains. We cannot keep the position we now enjoy, unless there is a steady flow of competent younger men coming along who will replace and augment those now in positions of importance.

Engineering is referred to as the fastest growing profession. There's a yearly demand for 80,000 graduates in all branches of engineering. To fill this demand, it's expected that about 17,000 engineers will be available in 1954, about 20,000 in 1955, and perhaps 26,000 in 1956. With so small a part of the demand filled by men graduating from our colleges and technical schools, or returning from the armed services each year, there is a great need to encourage young people to consider engineering and the other technical fields for their careers. Who is in a better position to accomplish this than men like ourselves assembled here?

We have to take an active part in selling technical training to high school students. Then we must follow through and sell them and the public on the importance and desirability of our industry. We'll need to provide proper training following graduation, and follow up on a continuing basis as they advance in our industry.

First of all, there's the job of interesting youngsters in technical work as a career, regardless of the field or industry in which they will eventually practice. We should, therefore, work with other industries in promoting vocational guidance days in our high schools, in publishing pamphlets and books that explain the need for technical men and the opportunities that await them, in planning plant visits to enable the youth of our communities to see for themselves what industry is really like and the challenges it offers, and in providing Summer employment for high school juniors and seniors (where their age permits) so they can become acquainted with industry and the advantages of a technical education. These steps would help increase the technical enrollment in our universities and thereby tend to meet the demand for technically trained graduates.

But, of course, all this won't increase the attendance at our TAPPI meetings unless we go ahead and not only work to increase the number of technically trained individuals, but also make sure that a proper number of them become interested in employment by pulp and paper mills. This effort is a job for the technical men now in our industry.

If anyone does, we should know what interests a young engineer or what is likely to appeal to a young chemist or physicist or mathematician. We, if anyone, should be able to point out that the satisfaction of his needs and desires can lie in our industry.

Does he want glamor? The common idea, I think, is that industrial glamor lies in the big chemical companies or in the giant manufacturers whose products

GEORGE H. PRINGLE, President of TAPPI; Vice-President in charge of White Paper Operations, Mead Corp., Chillicothe, Ohio.

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and names are known in every household. But is a big catalytic cracker really any more glamorous than a modern fourdrinier? The name of, say, General Electric is no doubt better known than that of any paper manufacturer. But are its products any more vital to our high standard of living? Properly interpreted, paper has as much glamor and importance—for the technical man—as any other industry.

Is the young technical man looking for responsibility or opportunity for service? I think you'll all agree that the pulp and paper industry has plenty of both to offer.

Is he looking for a challenge, a test of the knowledge he acquired in school, of his own skill and talents? Can anyone tell me of an industry that uses a wider selection of modern skills and technologies than pulp and papermaking does? Think of the problems in power, in transportation, in product movement we face, as well as the specific problems of paper manufacture. Think of the physical and chemical knowledge of our product still to be acquired, and what a more exact knowledge can do for our manufacturing skill. I think you will agree that there is plenty of challenge in paper; that although we are one of the oldest of the mass production industries, we are still ringed round with frontiers for the technical man to conquer.

The problem is for us to communicate this knowledge of the glamor of paper and its usefulness and technical challenge to the young technical man coming out of school today.

One way to do this is through providing worth-while Summer employment for technical students, preferably out in the operation. When I say "worth while," I am not referring solely to the character of the work provided which could be rather menial, if it was not accompanied by the type of interpretation and guidance which would give the technical student a real appreciation of the opportunities in the plant. You can't assume that he will get all that by himself—not even if he's the kind of top material we hope to obtain. Without some degree of interpretation, the Summer job can be a relatively worthless, sometimes even a harmful experience. If it's worth while to bring a boy into your plant, it's worth while to see that he has a chance to understand all the opportunity and future that it encompasses.

Another way we can work toward a fuller appreciation of our industry and its desirability as a career for young technical men is through pamphlets and other publications issued to the colleges. Such literature should be forward looking and be written for men of the 50's; and its appeal should not be concentrated on yesterday's graduates. Those of us who remember the thin years of the 30's are sometimes inclined to overweight the stability of our industry in times of decline. Papermakers eat when other businesses are sadly undernourished. In stressing this situation, a real and tremendous advantage of our industry, we tend to overlook that ours is also an industry of great growth. Look at the way it has surged upward in the last 25 years. Twenty-five years ago, in comparison with other industries paper ranked eighteenth in production. Today it is reaching fifth place, and only automobiles, steel, oil, meat packing, and cotton manufacturing are larger. An appreciation of this growth and progress has tremendous appeal for the boys in college. No matter what you hear about their seeking security and a soft berth for life, they have their eyes set ahead and are certainly at least as interested in the life and vigor of our industry as in its safety and security.

The lending of encouragement and assistance in the introduction of paper problems and technologies into college chemistry and engineering courses is of prime importance. Many a man goes through college today in ignorance of the real technical challenge presented by the paper industry. Neither his lab nor textbooks provide such information. Obviously to overcome this situation, we need to help college teachers to know more about our industry and to learn that our problems can be helpful to them in teaching their subjects. Maybe we need to call on them a little more often for consultation or advice; nothing helps a man understand your problems like asking him to help you solve them.

Of course, we can help interest young technical men in our industry when we interview them for employment. In my own company, we try to go a step further. When we invite young men in whom we are especially interested to visit us in Chillicothe, they are given opportunity to talk with two or three men in top management positions. This procedure helps them gain a better picture of our training program, of the chances for advancement in the company, and underscores the value we place upon the selection and promotion of our technically trained people.

This business of maintaining the position the technical man has gained in the paper industry doesn't stop, of course, just by interesting young men in the industry and bringing them into its employ. Beyond that initial step we must see that they have the right chance to grow.

A good training program helps here, for it gives the graduate an opportunity to find himself. Does he want to work up in the organization through operation, or are his interests largely technical? This training program should cover the entire mill organization, including paper machines, finishing, pulp mill, maintenance, steam power, electric power, drafting room, technical service, accounting, personnel, and stores. The young graduate should have a definite assignment to the head of each department for a period of from 2 to 8 weeks. This time would depend on the size and importance of the department.

Before being assigned to a given department he should be informed concerning the type of work carried on there. A set of questions covering the main points of importance is helpful at this point. At the completion of any department assignment, the young graduate should be required to prepare a report with flow sheets covering it.

Usually, the plant engineer or technical director is responsible for the group in training. He should hold weekly discussion with the trainees, outlining their progress and answering any of their questions. This training program will require about 12 months. Since its context is of a general nature it should be applied to new graduates in all branches of engineering. Following this training program the graduate is assigned to a special department for more intensive training. The capabilities of the young graduate and the viewpoint

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of the company should be carefully considered in making his assignment.

His placement following the training period should take into consideration how his own inclinations have been influenced during his early months of association with us. But don't forget him after he is given his initial job assignment. At least once a year as an aid to his growth a survey of his progress should be made; then his developing capabilities can be put to their best use. Such decisions should be made by an executive of the company, since he has the broad knowledge essential in placing these men where they and the company will profit most.

Our program calls for a system of continuing salary increases on a step basis for at least 4 years. The plan operates on a merit basis until the graduate becomes established in the organization.

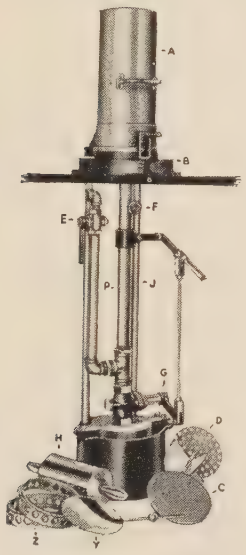
One of the most important lessons we have to teach the young graduate is the significance of human engineering. One way of doing so is to set up your departmental supervision, with a team in charge, which consists of a technical man and a practical man; either of whom could be in the top position, with the other as his assistant. The young technical graduate must learn to work with the practical man in order to obtain from him the benefit of his practical background and experience, without which no technical training is worth while. I might add that he needs to learn how to work with the unions, too, because they are going to be a permanent part of the scene.

Once the technical graduate has taken the first step along the operating route, he should look forward to progressing upward through operating management channels to the position of production manager in charge of all operations. If he selects engineering as his path of advancement, he should look forward to attaining the position of plant engineer in charge of engineering, construction, steam power, electric power, and maintenance. A third route upward is, of course, through technical service, and he should look forward to heading up the technical service department of the mill.

From these three positions, viz., production manager, plant engineer, head of technical service, the road of advancement leads on to that of mill manager and on upward in the organization.

We must realize that any good basic engineering training is good background for an operating position. Such training, together with a good personality and ambition to advance, should make a man a competent supervisor. A good personality and ability to work with and handle men is of vital importance in addition to knowledge of specific branches of technical training, whether they be chemical, mechanical, electrical, or civil.

We can pick men with good educational backgrounds. We can try to determine that they have the right personal traits and capacities. But we still have a great task and a great responsibility to help them grow and to acquire breadth of view and experience. When they have achieved this type of perspective, the maximum contribution of their training and mental discipline to the pulp and paper industry will be achieved.



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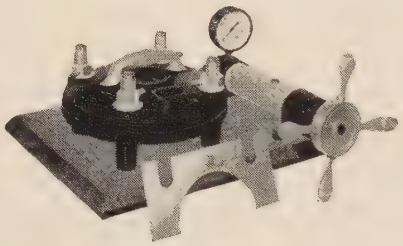

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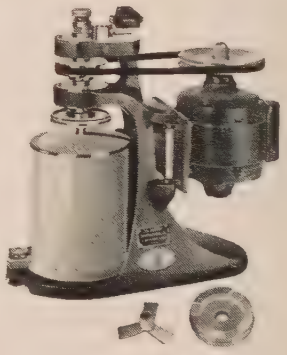

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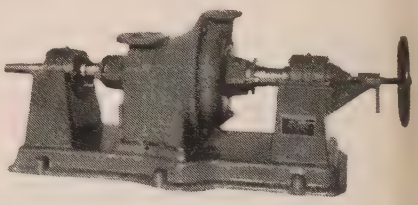

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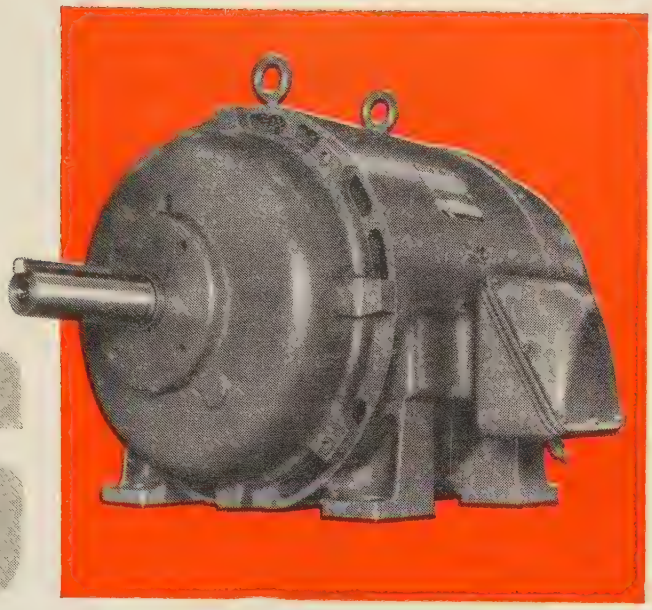

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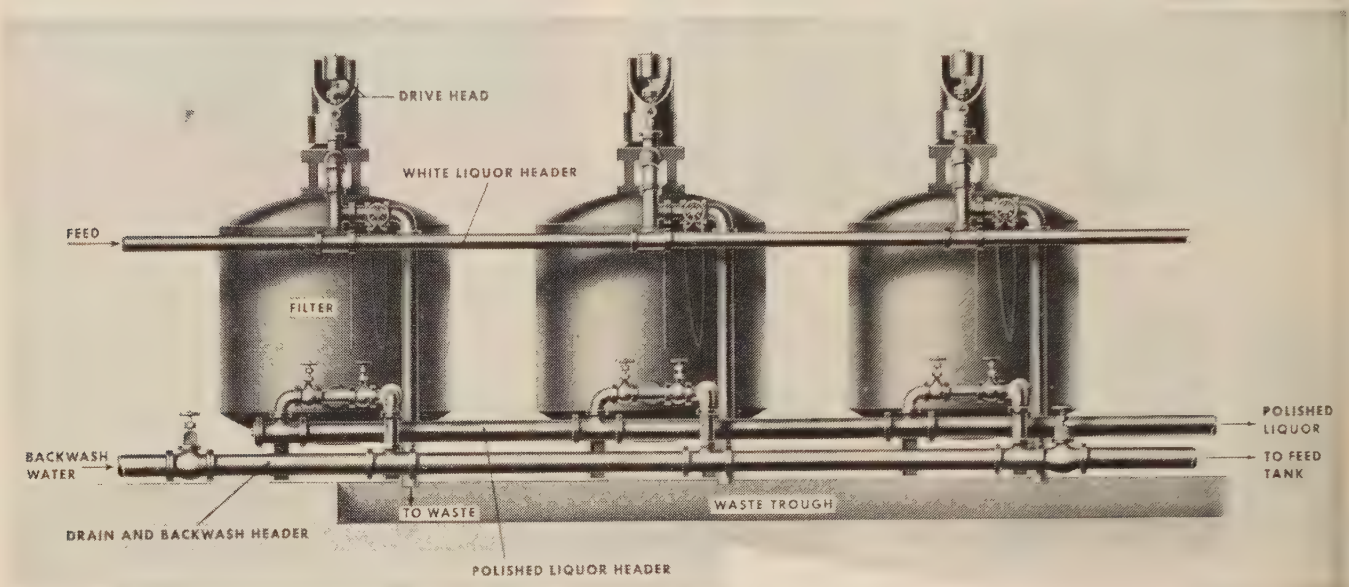

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For further information on the Dorrco White Liquor Polishing Station, write The Dorr Company, Stamford, Conn., or in Canada, The Dorr Company, 26 St. Clair Avenue East, Toronto 5.

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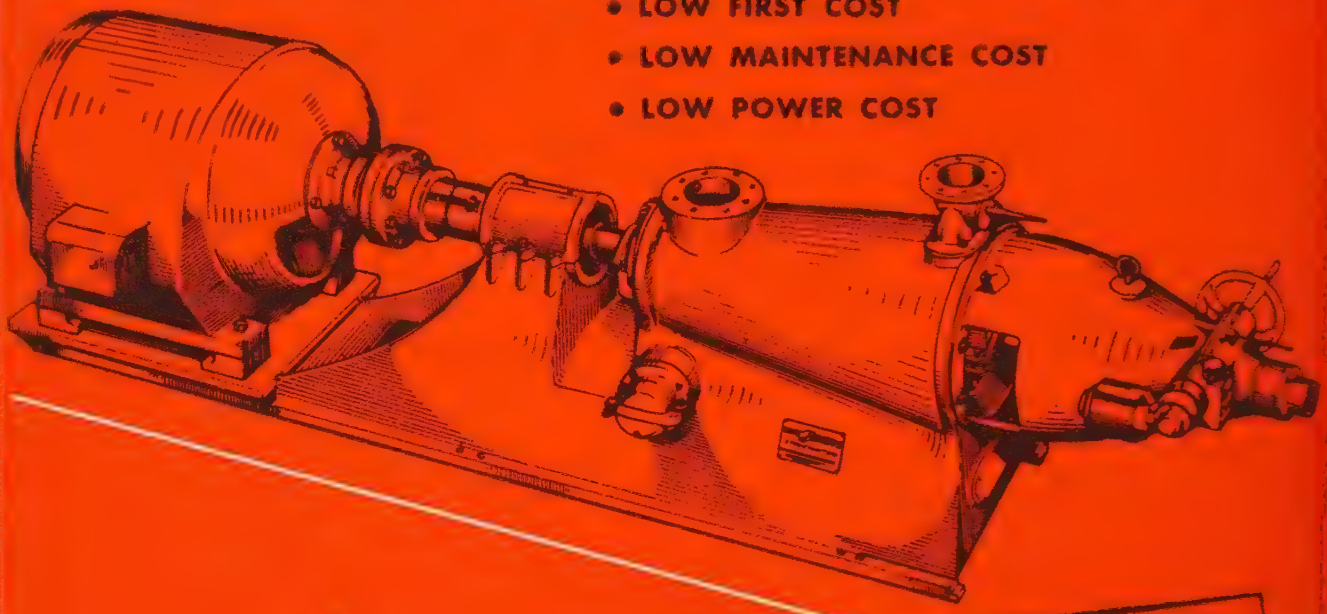

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Pulp Quality After Applying 600 HP Hrs. Ton	2.20	325
Fibre Length — MM*	250	6300
Freeness — CC CS	7000	37
Breaking Length — MM	45	144
Burst — Metric	182	
Tear Factor		
		2.05
Pulp Quality-At 400 CC CS Freeness	2.32	550
Fibre Length — MM*	410	5800
Power Required — HP Hrs. Per Ton	6100	36
Breaking Length — MM	42	172
Burst — Metric	218	
Tear Factor		

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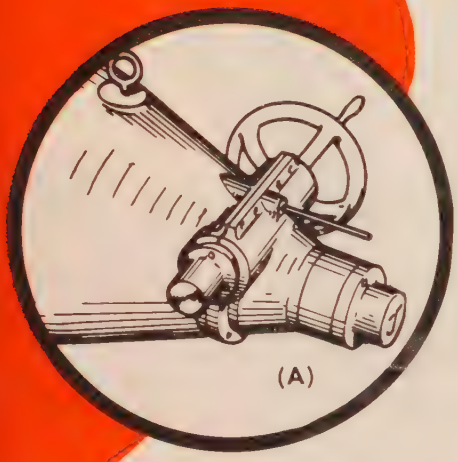

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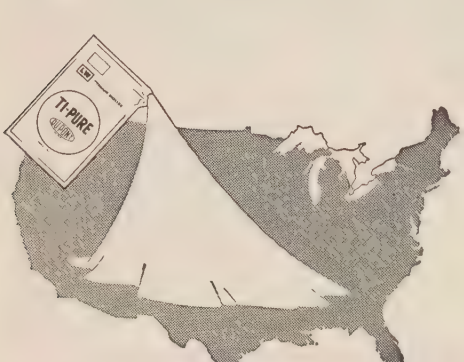

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THE TASKS AHEAD OF US

GEORGE OLMSTED, JR.

George Olmsted, Jr.

I WOULD like to discuss with you the paper industry—your industry and my industry—the accomplishments of the past and the tasks ahead of us.

In any such discussion we must have perspective, and so I go back 30 years ago to 1924 when I first started to work for the Warren Co.

At that time people didn't know very much about the paper industry and, as an example, I vividly remember telling a friend of mine that I was choosing the paper industry as my career. He immediately wanted to know whether I was going to make newspapers (and I suppose by that he meant newsprint) or whether I was going to sell them on a cold and windy street corner. The comment, I think, is typical of what the American public knew or thought about the paper industry 30 years ago.

Just the other day that same friend of mine, who latterly had been reading that the year 1954 would see drastic declines in the automotive industry, in appliances, and in textiles, but that in contrast the paper industry as a whole would be relatively untouched by the current recession—that same friend asked me how I happened to be so lucky as to have picked the paper industry for my life's work.

These two comments made 30 years apart by the same man express better than anything else the phenomenal progress which has been made in our position in the American economy.

Of course there are some underlying reasons for that progress.

In the first place we are one of the few industries in this nation with a replaceable raw material. You can reach the end of domestic copper, you can run out of domestic iron ore, you can squander your inheritance of petroleum, but you don't run out of wood for wood can be grown and harvested like a crop over and over again.

A second underlying reason for our progress lies in the fact that our industry is predicated on cellulose. Cellulose is about the lowest cost film-forming material that is known. Up to this point, at least, there has never been a substitute for it, and yet it in turn can substitute for many other materials.

GEORGE OLMSTED, JR., President, S. D. Warren Co., Boston, Mass.

And a third basic reason for progress is to be found in the fact that paper and paper products are commodities which are widespread in use. Throughout the day from early morning till late at night the American public is using paper in one form or another and paper is almost in the category of air and water in flowing through our daily living.

But these basic reasons for progress—important as they may be—would not by themselves have brought us to our present position unless you and all the others in our industry had accomplished a great deal by your own efforts and ingenuity.

Let me illustrate what I mean.

Let's go back once more to 1924. At that time our population in the United States was 112 millions. Right now, as we sit here today, our population is approximately 161 millions. This is an increase of 44% in a matter of 30 years.

Predictions are that this curve will rise further on account of an increasing birth rate, and to a point where our population in 1975 will be in the neighborhood of 210 millions. If that proves to be true we shall have an 88% gain in approximately a 50-year span—the greatest growth period in the history of our country.

Except as we have contributed some individuals in our own families to these statistics, we of course have had nothing to do with this population increase, but the increase is important because it has provided over the past 30 years, and will continue to provide over the next 20, an expanding base for our economy.

But we have had a very great deal to do with the curve which represents the consumption of paper and board in the United States.

In 1924—our starting point for this discussion—consumption was about 9 million tons a year. Consumption last year was about 31 million tons and this is an increase of 240% made in the period when population was growing only 44%.

The reason for this disparity—the reason why the consumption curve is so much higher than the population curve—is to be found, of course, in per capita consumption which went from 164 lb. in 1924 to 390 lb. last year.

That's a startling performance and one might well ask the question "How has the industry done this?"

It's been done by you men, by salesmen, by management, by the industry as a whole. It's been done by ingeniously substituting a web of paper for other materials and thus developing wholly new fields of consumption.

As Al Smith used to say, "Let's look at the record" and see how our phenomenal growth, as shown in this consumption curve, is based on the principle of substitution.

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The fiber shipping carton has all but supplanted the wooden case and today container board manufacture and its collateral 9-pt. corrugating is an industry with literally millions of tons of consumption—still growing and with no end in sight.

The paper container for milk has substituted for the glass bottle, and though this is a fairly recent development, nevertheless close to a half-million tons a year are being consumed in this manner. About 40% of all the milk that is sold is now in a paper container and at least 90% of the milk sold in super markets and chain stores is packed in paper. Again, no end is in sight, for as the American housewife continues to change her shopping habits, more milk will be sold in super markets in paper and less will be delivered to the back door in bottles.

Multiwall sacks have substituted for textile bags of all sorts and descriptions and are now being used for packaging cement, fertilizer, chemicals, potatoes, fruits, and a constantly widening list of commodities and products. Again this is a relatively new industry, but it has already added over a half-million tons to our industry growth.

Facial tissue has substituted for the handkerchief, wall board has substituted for wooden sheathing. Impregnated paper laminated to plywood has substituted for wooden concrete forms. Sanitary food containers have literally made possible the frozen food industry, the super market, and the pre-packaging of an infinite variety of foods. Go into a super market some day and be impressed with what an industry we have. The cracker barrel is out for good—and we put it out!

Of course I have given you some of the most glaring of the new products and new uses, and it's true that most of these products I've mentioned are properly made in the south—in fact, it might almost be said that they made the great southern development possible.

But there are hundreds of other new items which are less spectacular, perhaps, but which are nevertheless important in our over-all growth, and many of these have been made in the north.

For example, plastic-coated paper as a substitute for cork in bottle caps, paper diaper linings, and in fact paper diapers themselves as a substitute for cotton, paper printing plates as a substitute for metal, reflective paper insulation as a substitute for rock wool or other forms of insulation.

The point I am trying to make is that we have done better than we should have done statistically, we have progressed much faster than population progressed, because we have been ingenious in developing new uses and new fields of sale for our basic cellulose film.

Everyone had a hand in this. Someone had to get the original idea and sometimes that was a technical man, sometimes a salesman, sometimes management, and sometimes an outsider. Then management had to risk research and development dollars on the project and later on, if the development was successful, had to risk enormous amounts of investment in new plant or in new machinery. Research, of course, did the development work and manufacture went through the grief of translating somebody's brainstorm to a production item. And sales had to introduce the product and expand the consumption.

So it's been an industry job where all have participated. It is the greatest job we have done over the past 30 years—this finding of new uses, this development of new products. It's the proudest banner we can fly.

And there's one other curve that's important—and that's the over-all profits of the industry.

It is difficult to get accurate industry profit figures and so I do not vouch for the exactness of these. But I know they are close enough to typify the trend.

While population was going up 44%, while in the same 30 years consumption was going up 240%, over-all profits after taxes went up about 325%.

This increase came because of the rapidly expanding volume as shown on the consumption curve and also because the industry has displayed sound economic statesmanship over the past 15 or 20 years.

We should never be apologetic for these profits. These profits are a fair return on investment—no more and no less. These profits are a fair percentage of profit sales—no more and no less. These profits are the result of fair pricing practices in relation to costs of manufacture.

We need these profits for the future growth of our industry, for investment in plant, for modernizing plant, for research insurance. Without these profits we should stagnate and ultimately wither. And so a healthy industry from a financial standpoint is of prime importance to us all.

From these curves you can easily see why the financial men of this country are beginning to like us.

Years ago we were pigeonholed as a feast or famine industry and except for the most out-and-out speculator our securities had a somewhat sour smell. But today—because of this consumption curve and this profits curve and because there are many other signs that at long last we have sound industry leadership—today for those reasons the bankers and brokers look favorably on us, and to a point where the securities of a number of the larger companies in our industry are found in the portfolios of investment trusts, insurance companies, and the like.

This is a further—and perhaps the ultimate—proof that our industry has come of age, has become respected, and has taken its full and proper place as the fifth largest in our economy.

But this is all ancient history. True, it's history of which we can be very, very proud, but after all, it's water over the dam. As a customer friend of mine is prone to say—"What have you done for me lately?"—and as we might properly ask ourselves "What are we going to do in the future?"—"What are the tasks ahead of us?"

Obviously our job over the next 20 years is to be sure that these curves which we have been discussing continue their past trends.

As I said before, we don't have to worry about the population curve. People who figure such things tell us that in 1975 we'll have 210 millions, which is an 88% gain over our starting point in 1924. As a practical matter, we'll grow as much in the next 20 years as we have in the past 30. So it seems certain that we'll have not only a continuing growth but, even more important, a steadily rising curve.

But these other two curves will be what we ourselves make them. Inasmuch as the profit curve is controlled

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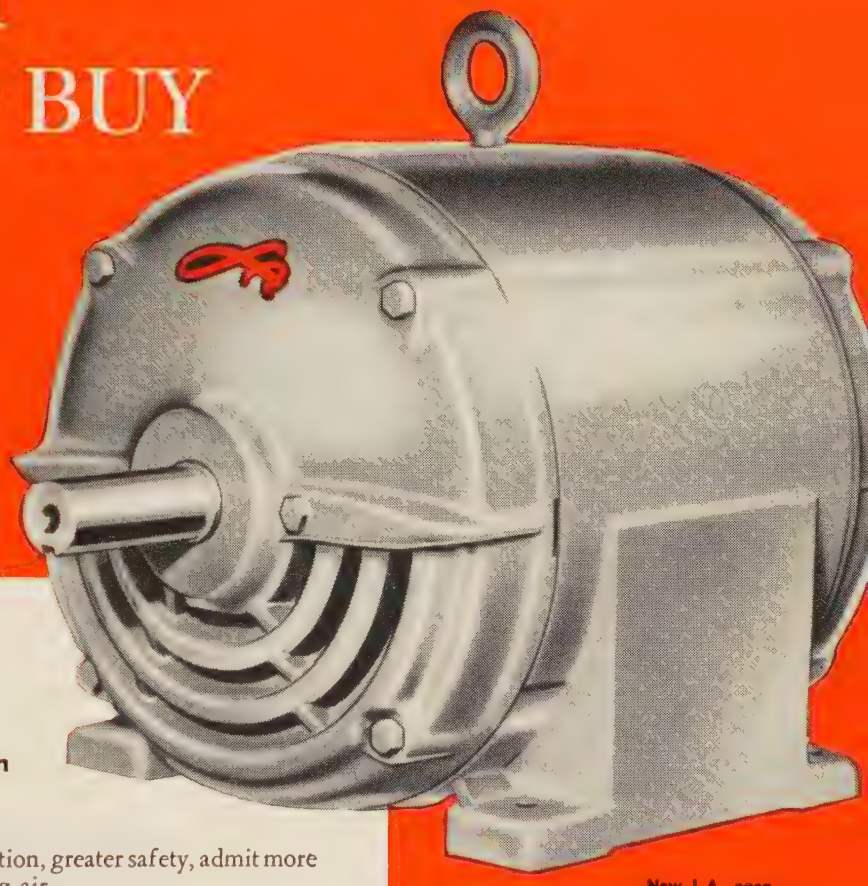
electric motor BUY

A smaller, better power package to meet new NEMA standards

with NEW MODERN STYLING



New L.A. open, drip-proof motor

plus

Improved ventilation
New conduit-box arrangement
New bearing construction
More compact design and better protection
More versatile mounting

Here you have complete use of modern motor materials, design techniques and new manufacturing methods. You also get more power in a smaller package — and clean, streamlined motor styling to add modern appearance to the equipment these new motors drive.

This new styling is completely functional. Ventilating grilles, for example, blend into the general motor design — yet they provide better protection, greater safety, admit more cooling air.

Completely enclosed housing provides protection for the new L.A. line in any mounting position — floor, sidewall, or ceiling.

Standardize now on the new L.A. line for both your product and your plant — and get the most modern motor construction available. See your nearby Louis Allis Sales Engineer today for the complete story.

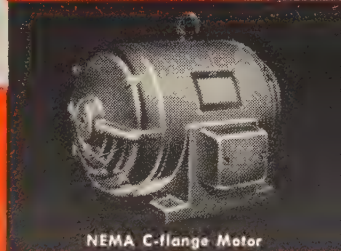
THE LOUIS ALLIS CO.

Milwaukee 7, Wisconsin

LA-102

NEMA D-flange Motor

Vertical NE flange M



NEMA C-flange Motor

We specialize in SPECIAL MOTORS — *and* PROMPT DELIVERY, TOO

There's a Louis Allis special motor for your toughest application. Whatever electrical or mechanical modifications you need, check first with Louis Allis.

very largely by the consumption curve, it is this one (the consumption curve) that we must think about. This is the one for all of us to work on.

We know that we have gone from 164 lb. of consumption per person in 1924 to 390 lb. last year. But what will that figure be 10 years from now? What will it be in 1975? Will it be 450 lb., or 500, or 600? Or will we slide back to 400 or 350?

That is the $64 question. That is the essential ingredient of our future. That is the catalyst for our industry.

If we are to increase per capita consumption and thus carry on this splendid curve we must induce the American public to buy more of our products. It's as simple as that—simple, that is, to say, but very, very difficult to accomplish.

Well—how do we accomplish it?

There are, I think, three things that we can do.

The first—and I shan't dwell on it at any length, is that we shall need aggressive merchandising. We'll need advertising, salesmen, promotion, everything in the merchandising book, if we're to sell more things to more people over the next 10 to 20 years.

The second thing we'll need are low costs of manufacture.

When I press for low costs I'm not trying to be a so-called "brass hat" who yells for lower costs every Monday morning just to keep the heat on and the needle in and well twisted, but rather because a low manufacturing cost for our products will be essential if we are to sell more of them to more people. The public has just so many dollars to spend and we've got to get them to buy our goods instead of something else. To do that our products must be cheaper or they must be more useful or they must be more labor-saving. We want the low cost of manufacture not because of its effect on our profits *per se* but rather because a low cost will help us sluice business away from other industries and thus increase our share of the take of the public's income.

You know better than I how to get these low costs. That's a technical problem. It's your problem. It's one of the great potential contributions you can make to our future. We need more efficiency, less waste, fewer job lots and rejects. We need lower raw material costs. We need cheaper substitute materials.

For example, we need badly, I think, an additive which will produce what I call "synthetic strength"—and thus permit us to use more short fiber in our various products.

As you well know, long fiber is the expensive ingredient in papermaking in many areas of the country. Our economy would be improved if we could use a greater proportion of the short fiber made from hardwoods, or a greater proportion of reclaimed paper stock.

Unquestionably there are many other approaches to this problem of low cost, but this surely is one of the major tasks ahead of you and other technical people in the industry. Your success on the problem of cost will have much to do with the future direction of this all-important consumption curve.

And the third thing we need is new products, new applications for the cellulose film known as paper, new diversification of our operations.

Everyone gets in on this act because we need novel ideas—the "flash of genius" that the Patent Office talks about—and these ideas may come from any number of sources. But after the idea comes research—the scientific approach, technical development. That's where you fit into the picture and that's why the bulk of the job becomes your problem.

There are almost limitless fields ahead of us. Paper to replace metal, paper for cotton cloth, paper for acetate film, paper for metal cans—there are countless possibilities. In this connection, we must look upon our industry, I think, as more and more a chemical operation and less and less an engineering operation. The chemical possibilities are great and, in addition, this sort of thinking would permit us to utilize in some directions the many fascinating developments of resins, films, and techniques that are being produced in the research laboratories of the chemical industries themselves.

I personally believe that as an industry we are really just starting on this fascinating game of substitution. It is generally recognized, I think, that it takes about 15 years for a research laboratory to get itself organized, coordinated, and salted down with the fundamentals under its belt so that it can begin to produce. In my judgement, widespread research in the paper industry didn't get started until the early 1940's. The laboratories started then are just beginning to blossom now and if the 15-year timetable is correct, then sometime after 1955 the fruit should ripen and in ever-increasing quantities.

But it all takes work—technical work—your work. So—these are your responsibilities.

1. To be ingenious enough, curious enough, persistent enough, to hammer down cost of manufacture.
2. To be imaginative and brilliant enough to create new products for us to sell to new customers in new fields.

And there is a third task you must accept—and that's getting the right technical men—and enough of them—to make a career in the paper industry.

At long last the United States Government has discovered in its competition with Russia that technical leadership is the important thing—more important than size or mere brute strength. The same principle holds true in industry. It is technical leadership that counts!

So when you hire a man today you are determining what your company—and hence your industry—will be like 25 years from now. If you hire a low caliber man, then your company and your industry will be low caliber. If you hire too few men, then your company and your industry will lose their dynamic momentum.

Man power is everything! We must attract enough of the right caliber men to our institutions to insure that our efforts as shown on these curves will be carried on with no interruptions and with no faltering dips.

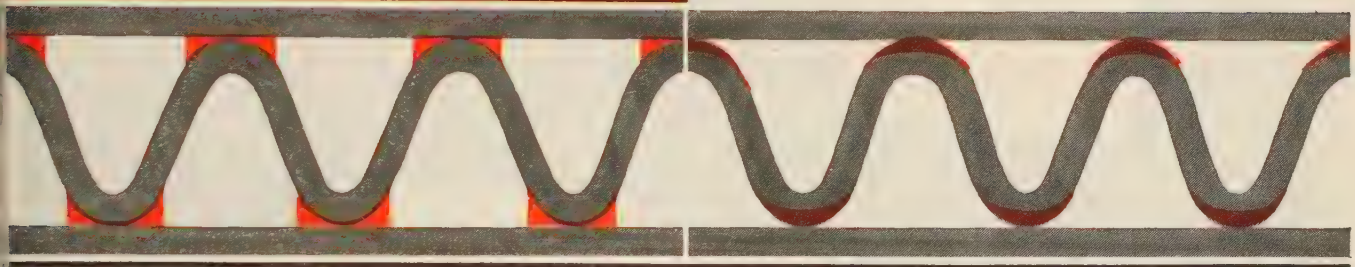
These are your tasks—to hammer down costs, to develop new products, to attract adequate technical personnel.

How well you do them will largely determine the future of our great industry!

Received Jan. 18, 1954. Presented at the 39th Annual Meeting of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 15–18, 1954.

GEL POINT control insures good adhesive

BOND



GOOD BOND

This graphic illustration shows how bond is improved if penetration is controlled with the inclusion of a fraction of a percent of Kelsize in the starch adhesive formula. Retention of water and water soluble chemicals in correct proportion with raw starch at the glue line is essential for proper gelatinization of the raw starch mixture.

POOR BOND

The above illustration shows how the moisture of the adhesive tends to migrate into the medium, leaving an unbalanced starch mixture at the glue line. Poor bond will result if the moisture of the starch paste soaks into the liners and medium before heat is applied and gel point reached.

KELSIZE

Precisely engineered for specific uses, Kelco algin products are manufactured to absolutely uniform standards by the Kelco control procedure, which includes 46 distinct tests.

To insure best possible bond, call our nearest regional office for a free demonstration of Kelsize by one of our experienced paper technical men.

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Announces **the purchase of:**

BRIDGEPORT... Knife Grinders and Circular Knife Grinders

DIAMOND..... Facing and Surface Grinders and Heavy Duty Pedestal Grinders

BRIDGEPORT... Abrasive Cut-Off Saws

Model No. 75 H.D. Knife Grinder.

...this equipment formerly produced by

BRIDGEPORT SAFETY EMERY WHEEL CO.
BRIDGEPORT DIAMOND MACHINE CO.
DIAMOND MACHINE CO.

LOBDELL UNITED COMPANY of Wilmington, Delaware announces that it has acquired the engineering, patterns, and tooling and all rights to the manufacture and sale of the Bridgeport and Diamond lines of grinder, and abrasive cut-off machines.

Knife grinders, vertical and horizontal facing grinders, and a number of special purpose grinders make up the grinding line. LOBDELL UNITED, for more than 50 years, has been a leader in the roll grinding field, and the acquisition of the Bridgeport and Diamond line complements the roll grinders and brings LOBDELL's expert knowledge and skill to a wider field. Abrasive cut-off saws of manual, semi, and fully automatic types in a number of sizes make up the saw line.

LOBDELL also makes a cold cutting friction saw for cutting large shapes and bars and the abrasive cut-off machines will cover the smaller sizes of shapes and bars.

Parts and service can be supplied for all machines now in use ... new equipment will be quoted to suit your needs. Write us for further information.

- Lobdell Paper Mill and Steel Mill Roll Grinders
- Bridgeport Knife and Facing Grinders
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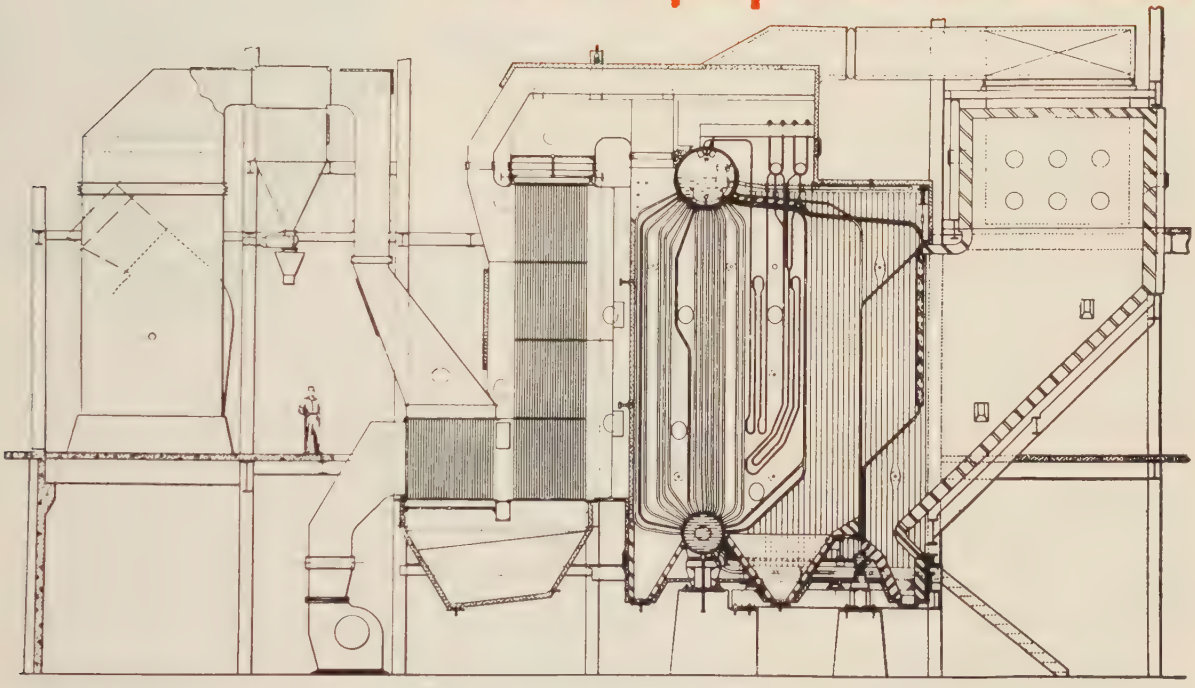
- Cold Cutting Friction Saws
- Abrasive Cut-off Saws

1836 **LOBDELL UNITED COMPANY** 1954
WILMINGTON 99, DELAWARE
A SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY

2 B&W MgO RECOVERY UNITS to serve pulp mill in ALASKA



Ketchikan Pulp Company—the first pulp mill in Alaska—will produce dissolving pulp employing the Magnesium Bisulphite (MgO) process. This will be the first new plant to use this process.

B&W is the exclusive licensing agent for the MgO process. Each of the two B&W heat and chemical recovery units for this plant is designed to generate 93,000 lb of steam per hour . . . will consist of a two-drum bent-tube boiler with superheater designed to operate at 860 psi and 825 F total temperature, and equipped with Y-jet liquor atomizers set in a refractory furnace.

In addition to the recovery units, two B&W two-drum Stirling boilers are on order, to be fired with oil and bark. Each power boiler will generate 160,000 lb of steam per hour at 860 psi and 825 F total steam temperature.

B&W invites your inquiries relating to heat and chemical recovery problems for both the sulphite and sulphate pulping processes. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

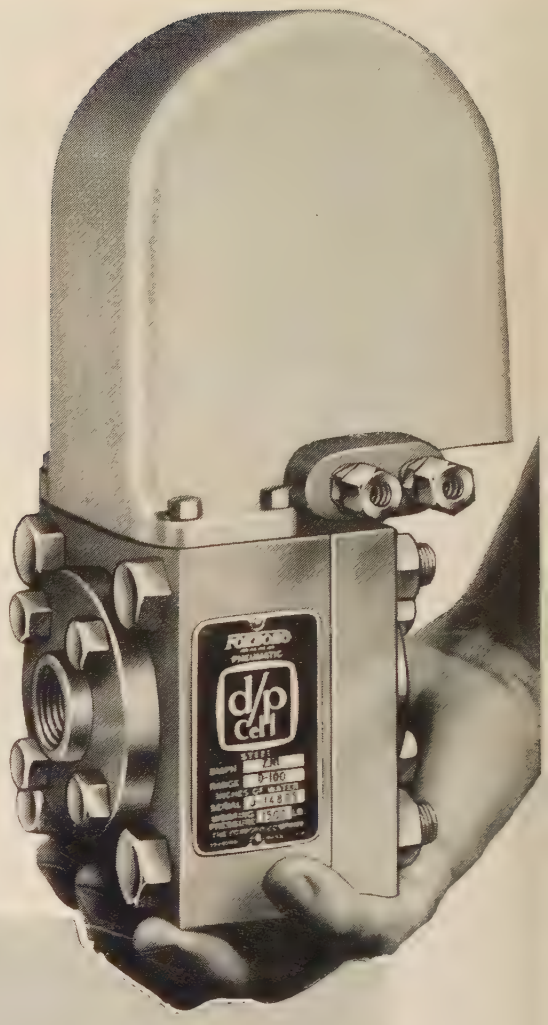
BABCOCK & WILCOX

BOILER DIVISION

P-779

Floatless Liquid Level Control... for

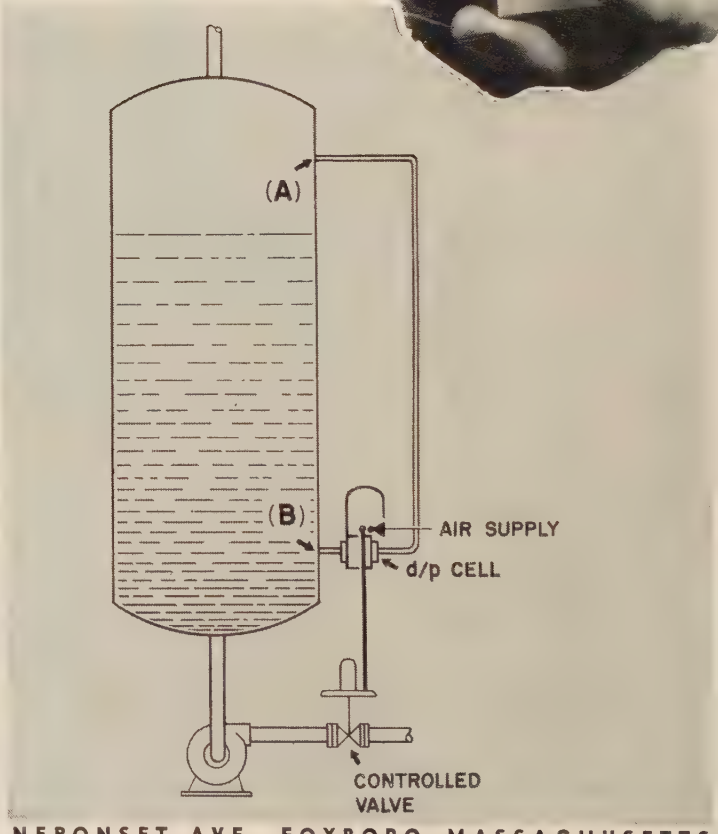
- condensate level in digester heaters and black liquor evaporators
- brown stock washer filtrate tank level
- precipitator wet bottom level
- other pressurized-vessel processes



RIGHT FROM THE START the simple design and operation of the Foxboro d/p Cell will save you time and money on many liquid level control applications. This unique differential pressure transmitter eliminates maintenance problems of float-type controllers. And it operates the valve pneumatically, without additional control devices.

The Foxboro d/p Cell is light in weight, compact, Type 316 Stainless Steel construction. Ranges from 25" to 800". Initially low in cost, the d/p Cell installs externally with simple piping connections.

For the logical solution to *your* liquid level control problems, investigate the Foxboro d/p Cell. Write for Engineering Data Sheet 000-12.



The d/p Cell measures differences in heads between maximum level (A) and minimum level (B) — transmits air pressure *directly* to control valve, in proportion to level change. Prevents pump cavitation and tank overflow.

THE FOXBORO COMPANY, 783 NEPONSET AVE., FOXBORO MASSACHUSETTS, U. S. A.

FOXBORO REG. U. S. PAT. OFF. **d/p cell**

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IF YOU USE ANHYDROUS SODIUM METASILICATE

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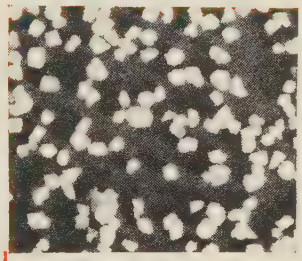

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Exacting production control results in a carefully sized material that is best suited to your handling or formulating needs. Screen size—all through 10 mesh, 0.3% maximum through 100 mesh.

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Dissolves readily and gives clear, sediment-free solutions.

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Extremely low in iron and other undesirable impurities.

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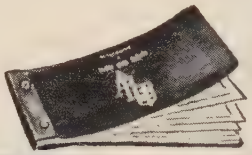
Allied Chemical

Basic Chemicals For American Industry

SMEALLIE & VOORHEES, INC., Amsterdam, New York, produces a wide range of paperboards which are made into set-up boxes, folding boxes, and tubing in their own converting plants. They use Albany Felts almost exclusively on all three press positions of this six-cylinder machine. Ralph Demas (right), Plant Superintendent, reports "more tons per day" with Albany Felts.

Albany Felt Company's technically trained sales engineers constantly strive to improve felt performance on your machines. Just as twenty-five years ago Albany engineers introduced the revolutionary concept of individually designed, custom-made felts for each felt position, today they are supplementing this valuable service with actual operational studies which we term "felt performance check." This extra service, by analyzing the basic principles of felt operation in relationship to over-all efficiency assures our customers MORE TONS PER DAY. Even more important, Albany sales engineers are backed up by the industry's leading service engineers and felt makers, a complete service laboratory, an extensive research and development program, and a product *famous* for quality.



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Other plants: Hoosick Falls, N. Y., North Monmouth, Maine, Cowansville, Quebec

another major contribution to the industry's progress

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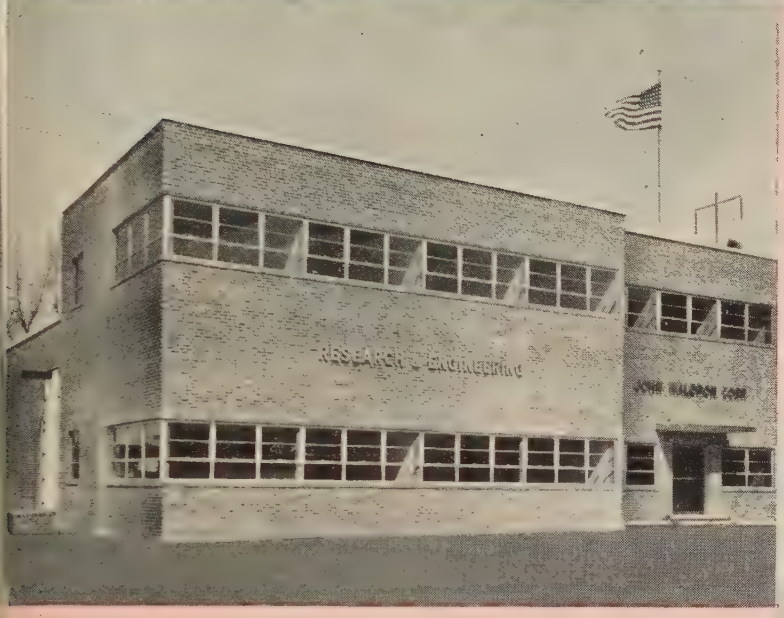
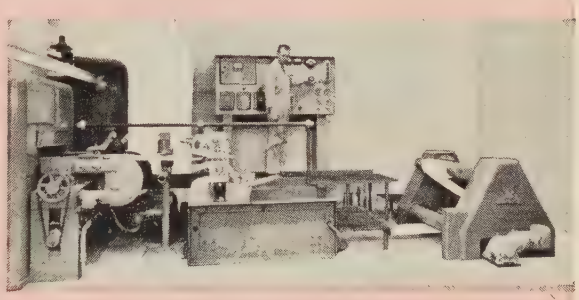
Research and Testing Laboratory



dedicated to the improvement of products and processes

One of the finest of its kind in the world, our new modern Laboratory is now in service for the benefit of the converting industry in determining most suitable machinery requirements and for the development of new products and better processing.

Tests are made for research and sampling purposes only. It provides a complete pilot plant web processing line, development machine shop, engineering design facilities and all performance measuring instruments.



We invite you to see this new laboratory. Your visit can be arranged by contacting us by phone or letter for appointment.

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Leaders In Web Process Engineering Since 1827

INCONEL
PREHEATER
TUBES
AT CHAMPION

Last Longer... Stay Clean Longer!

Started Something.
The Inconel tubes in this digester liquor preheater were installed almost five years ago. In view of their outstanding performance, the CHAMPION PAPER & FIBRE COMPANY has since put Inconel tubing into all 14 remaining preheaters at the Canton, N. C., mill.

Trial leads to 100% installation

Nineteen forty-nine was a busy year at the Canton, N. C., mill of the Champion Paper & Fibre Company.

With rigid production schedules to meet, they'd been running digester liquor preheaters full tilt.

The mill kept up with schedules all right — but the preheaters showed the strain.

You can understand why. All 15 preheaters were going twenty-four hours a day, seven days a week. Inside the tubes —sulfate cooking liquor. Outside—pressurized steam at 354° F.

Ordinary tubes lasted just about twelve months. By then they were so badly corroded they had to be scrapped.

In June, 1949, Champion installed a trial set of Inconel® tubes in one preheater . . .

Today — almost five years later — those Inconel tubes are still in use.

Long life is not their only advantage, either, as Champion has discovered. The Inconel tubes also stay clean twice as long as the old tubes did. Not only does cleaning cost half as much, but Champion runs 17 more tons of pulp during the time the second washing used to take!

In short, the trial was a huge success. So Champion followed through — *they retubed their 14 remaining preheaters with Inconel.*

Keep Inconel in mind if you're having trouble with a metal used for any corrosive job in pulp, paper or board mill. And write us for a copy of *Practical Solutions for Metal Problems in Pulp and Paper Mills.* The revised edition of this helpful illustrated booklet is available now. You'll find it a valuable source of information.

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- BEATER DYEING

STANDARDIZED PIGMENTS TO MEET THE EXACTING REQUIREMENTS FOR PAPER COLORING

THE DU PONT LINE includes economical pigments of highest quality. There are colors for beater dyeing which have been especially processed for quick and thorough dispersion in water. They have better strength than the usual lakes for beater coloring. Use them for papers which must have good lightfastness.

All these Du Pont pigments are standardized for properties important to their use in paper. They may be adapted to the most exacting requirements.

You can get further information from your Du Pont salesman, or by writing to E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, 1007 Market Street, Wilmington 98, Delaware.

USE THESE DU PONT PIGMENTS FOR QUALITY PRODUCTION

Chrome Yellow • Organic Yellow Lakes • "Watchung" Red
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For makers of Quality Papers

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BLEACHED PINE SULPHATE

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CHLORINE DIOXIDE

Albacel is a bleached pine sulphate . . . the cleanest pulp of its kind available from any source. Chlorine dioxide bleaching gives it outstanding strength and excellent brightness.

Albacel is produced at Riegel Carolina's new pulp mill at Riegelwood, N. C., with every refinement and control known to modern pulp manufacture.

Riegel Carolina Pulps

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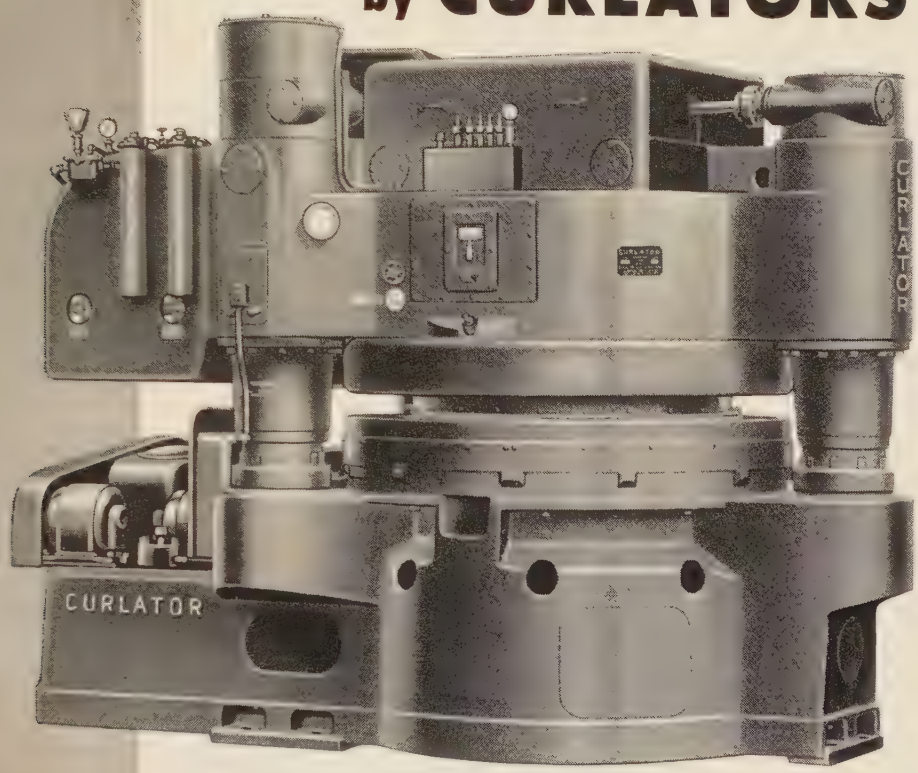
NOW Commercial 65% Yield News Sulphite is Here!

. . . made possible by CURLATORS



in continuous MILL OPERATION

65% YIELD OF NO. 1 SULPHITE FOR NEWSPRINT

UP TO 30% SAVING IN WOOD ALONE *PLUS* UP TO 30% SAVING IN SULPHUR, LIMESTONE AND STEAM

43% INCREASE IN DIGESTER CAPACITY

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The Curlator is the first and only machine to produce a first-class news sulphite pulp at 65 per cent yield in full scale commercial operation.

This "semi-sulphite" replaces normal low yield sulphite pulp pound for pound in the newsprint furnish.

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WRITE for News Bulletin on Commercial 65% yield News Sulphite.

THE PULP AND PAPER INDUSTRY IN THE FAR EAST

ROLAND A. PACKARD

THERE is no facet of our national life more important than peace and security. As a nation we are intensely concerned with the improvement of our strength as well as the strength of our allies. This means spiritual, economic, and military. No Godless force can succeed against such a formidable, well-balanced power.

Air transportation, radio, television, and the fast-expanding use of paper for the printed word have made our world so small that it has become vital to survival to concern ourselves with every nation.

The economic and industrial strength of the United States has been the wonder of the world. But, remember that democracy cannot live long with hunger where communistic pressure develops.

A well-known yardstick of the standard of living of any nation is the pounds of paper consumed per capita. With the United States using nearly 400 lb. for each person and some countries in the Far East consuming less than 2 lb., it can be easily understood that a continuation of any effort toward democratic freedom is skating on pretty thin ice with the low standards of living which exist. All of us must remember also that the 15 poorest countries of the world, where 50% of the people live, have less than 9% of its total income.

It is a certainty that the whole world today would be in a sorry state of chaos were it not that such as you and I and every other worthy American citizen, as well as those who have gone before us, had not laboriously helped to build the American enterprise system to where it stands today. Even with assistance from America, civilization stands at the crossroads. However, the author can earnestly and confidently state, that from his personal observations in Japan, Formosa, and the Philippines, together with personal conferences with others who have spent time on the mainland of China, in Korea, Thailand, and Indo-China, that it has become recognized that it is essential to promote the use of pulp and paper as an important economic link in any country's civilization.

	Per capita consumption of paper in pounds
Japan	35
Formosa	7
Philippines	9
Indo-China	0.7
Thailand	2.8
Korea (South)	2
Red China	1.9

All these nations are inhabited with branches of the Mongolian race, yet their respective national characteristics vary widely. Since details of the various peoples go beyond the scope of this paper, it is well only to note how they stand today in the consumption of pulp and paper.

ROLAND A. PACKARD, consulting engineer, Takoma Park, Md.

JAPAN

It is startling to note that the total area of the Japanese islands proper is about equal to that of the State of Montana which has a population of 600,000 against the 84,000,000 people living in Japan.

The per capita paper consumption table shows the relative progress of Japan over the other countries of the Far East.

It is just 100 years since Commodore Matthew Perry sailed an American fleet into Tokyo Bay with a letter from President Filmore. It was during this period that Japan developed into a modern power among nations following many of the concepts of industrial production learned from Western countries. Today, a good portion of the 84,000,000 Japanese have not been lifted from poverty. It is upon this segment of the population that the Communists feed, and in this country the threat is acute. They have connections abroad and the danger from that source must be contained. Industry with increased employment is a tool of importance. The Japanese have done a good job in the development of the pulp and paper industry.

Before the late war, most of the Japanese industry was under the control of the war lords; and from 1920 up to and in the period of World War II, the industrial trend was toward the development of equipment for capital goods manufactured particularly for the military. This movement extended into Formosa as well, which was the training ground for secret military developments. The pulp and paper industry was considered essential to the Japanese war preparations and the country's healthy economy even to the point of exporting as much of these commodities as possible. However, it was recognized that there was a limit to Japan's pulpwood supply, but it was concluded that with military plans already made, this would not be a serious problem in the future when pulpwood could be imported from an expanded empire. The fruition of the plans for this expanded empire was not realized for a sufficient length of time to harvest and transport any extensive quantity of pulpwood to Japan. Added to this disappointment was the loss of timberlands in Manchuria to Soviet Russia. It has been estimated that Japan's area of softwoods which can be economically harvested will last about 15 years. This situation has caused Japanese pulp and paper men to look toward Alaska as their nearest possible economical

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source of supply for this raw material. The main obstacles are inadequate foreign exchange and laws of the United States which cover these reserves. It has been reported by the *Paper Trade Journal* that the Alaska Pulp Co., a Japanese corporation, seeks to purchase a sawmill for a supply of lumber and wood chips; because

Fuji mill of the Honshu Paper Company. (Mt. Fujiyama in background)

the needs at home are pressing. Also, the reference added, that such a move might precede the undertaking of an integrated pulp and timber operation. However, there is decided opposition as expressed by representatives of the APPA at a Senate Committee meeting held early last month.

After World War II great changes took place in the industrial picture under the guidance of General Douglas MacArthur. The manufacturing empire of the nation was broken down under the Economic Deconcentration Law. The pulp and paper industry was reorganized into separate groups independently controlled in order to set up a Japanese enterprise system competitive in character, with ownership distributed among the people. This change is best illustrated by the following abbreviated financial picture of the Honshu Paper Manufacturing Co., Ltd., which consists of six paper mills containing 22 paper machines, one chemical plant, and one hydroelectric plant having a generating capacity of 11,850 kw.

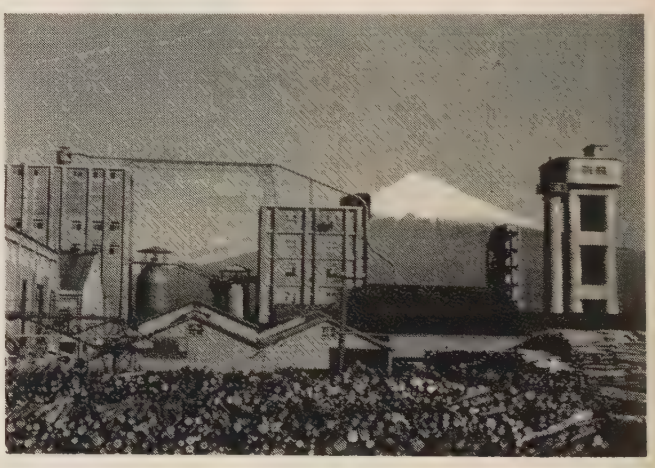
	Number of stockholders	*Number of shares held*
Financial institutions	126	3,706,240
Security corporations	309	666,810
Other corporations	177	380,190
Foreigners	12	7,740
Individuals	23,066	5,239,020
	23,690	10,000,000

This array of figures looks like the distribution of stock in a large American pulp and paper corporation. All told there are over 200 pulp and paper mills in Japan, among which are approximately 10 mills which may be considered, by American standards, as large.

Apparently MacArthur had the same genius in organizational work among industrialists as he did in the military. The cooperation given him in the pulp and paper industry has improved Japan's economic status. The following table shows the progress made before and after the late war.

	Mill capacity	*Total production*	*Capacity, %*	*Exports*	*Imports*
	Pulp (short tons in thousands)				
1931	NA	613	..	NA	111
1937	NA	973	..	139	512
1941	1565	1380	88	NA	62
1946	969	222	23	0	0
1949	1050	585	56	6	76
1950	1172	805	69	23	68
1951	1500	1170	78	47	124
1952	1680	1368	82	16	NA
	Paper and Board (short tons in thousands)				
1931	NA	615	..	94	NA
1937	NA	1600	..	135	70
1941	2297	1669	73	121	NA
1946	1162	231	20	3	0
1949	1403	689	49	7	12
1950	1507	960	64	22	0
1951	1636	1287	79	49	9
1952	1858	NA	..	NA	9

These tables show that production capacity more than doubled during the last 20 years, but was seriously curtailed during the war. However, the interesting outcome is that while the United States gave Japan financial support during several postwar years, the Japanese were satisfied to proceed on their own yardsticks of measurement of digester production and paper machine speeds without inquiring or perhaps caring what the corresponding optimum speeds were in modern American and Canadian mills. Added to this element came the prosperity resulting from high world prices of pulp during 1951 when large profits were made from the sale of pulp and paper manufactured in Japanese mills. Much of these profits was turned back into mill expansions. Many new digesters, grinders, and paper machines were built and installed. This expansion has been considered by some observers as overdone. With world pulp and paper prices be-



Pulpwood and pulp mill of the Honshu Paper Co.

coming realistic, it is easy to anticipate some marginal mills will shut down. The collapse of world prices, particularly on pulp, helped to turn Japan's balance of trade into a negative position. Unfortunately, at the start of 1954 this element has become serious because exports are not increasing. The answer is that Japa-

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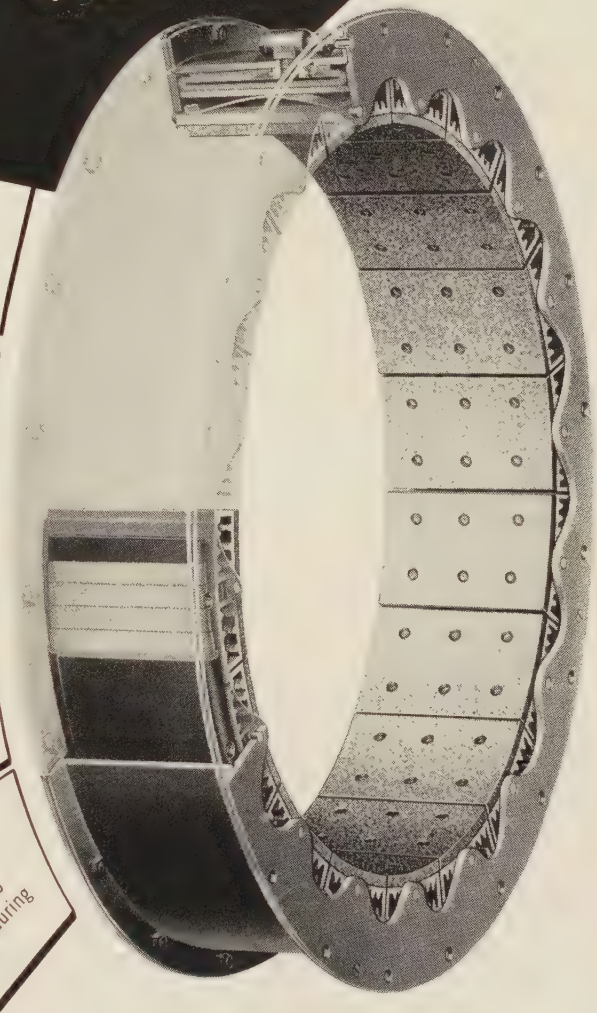

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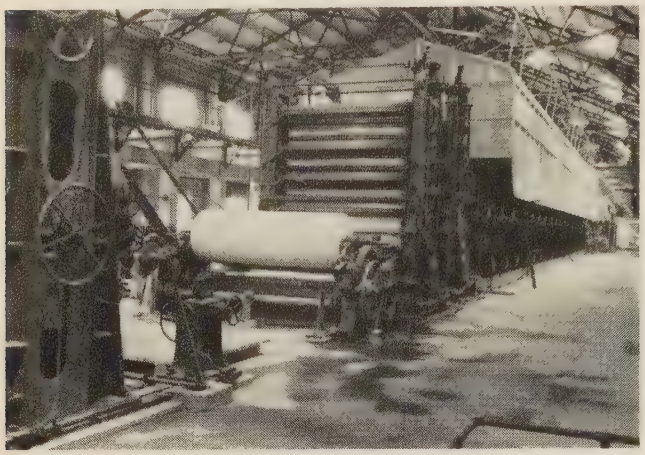
nese pulp and paper mills must cut costs of production and promote intensive sales effort, particularly in southeast Asia and the Middle East. Naturally, Japanese and Formosan industries are hoping that the trade door to the China mainland will open in the not



Typical paper machine in Japan

too distant future. This wish appears rather nebulous for some time to come.

The author visited the mill having the widest paper machine (168 in.), namely the Jujo Paper Manufacturing Co., Ltd., located just outside Tokyo. The president, Itsuki Nishi, was a venerable gentleman of about 68 years, who was an old papermaker and intensely interested in talking with an American familiar with the pulp and paper industry.

The variety of pulps and papers manufactured in Japan covers about the same ground as in the United States, except, of course, on a much smaller scale. Like many paper machines in Europe, the speeds average from 50 to 70% of the optimum speeds employed on similar papers and weights in the United States. Dissolving pulps have and are being manufactured on an increased scale even to the extent of American-financed promotion in order to supply rayon mills in and around the Far East. They were assisted by Yoshikuma Seki, managing director of the Mitsubishi Paper Mills.

Before leaving Japan, I must refer to handmade papers. Thomas K. and Harriet R. Tindale have made a 20-year study of this subject and published their findings in four volumes. They are replete with illustrations of an old papermaking village, a scroll, the original of which, was made in 1784 and reproduced in colors showing the process of making paper by hand. There are many samples of handmade sheets, the first of which was manufactured in 740 A.D. Watermarks of an extraordinary character consisting of elaborate landscapes and seascapes, flowers, fruit, Japanese women in native costume, etc. are used. This unusual publication sells for $250 a set, with the edition limited to 250 sets.

FORMOSA (TAIWAN)

Formosa is a strategically located island between Japan and the Philippines and as a matter of fact, it can be called a "frontier of civilization." It has an area about equal to that of the states of Connecticut and Rhode Island combined. Only 24% of this mountainous country is available for use for industry and agriculture. It is subtropical and is subject to typhoons and monsoons. This latter or rainy season (annual rainfall averages 100 in.) is the main source of water accumulation in the large Sun Moon Lake which feeds high and low head hydroelectric plants, the power from which is used generally to run the pulp and paper mills along with other industries which are distributed over the island.

This country is very intimately tied in with the "problem of Asia." There is no quick answer to the complications on the mainland. It has been centuries in the making and it will be generations to come before a completely satisfactory solution can be worked out. However, in Taiwan, as it is called over there, much progress has been made through the cooperative services of the United States Government working through MAAG (Military Assistance Advisory Group) and FOA (Foreign Operations Administration and formerly the Mutual Security Administration). This latter group, or "China Mission" as it is called, has developed a well-balanced program of rehabilitation of industry, farming, mining, education, medical assistance, telecommunication, transportation, and power generation and distribution. This program. . . is "to build conditions of peace under which men can walk in dignity, work in concert, and reach out—each in his own way—toward the moral and material advancement which freedom alone can bring. . . . Our military might, daily growing, is but the outer shield against the Communist threat. . . . We cannot feed the peoples of the world, but we can help them to grow more food. We cannot supply them with all the materials and machines they need, but we can give some and help them to use what they have more productively. We cannot alone defend the free world but we can help our partners to rearm and stand guard with us against war. This, in part, is a charter of action summoning free men to build the kind of world they want."

An important part of industry is the 30 pulp and paper mills on this huge island, 240 miles long and 90 miles wide. All but one of these mills were built by the Japanese during their occupational period. This one

Nilon dissolving pulp mill in Yonago, Japan

mill, consisting of a globe boiler for kraft cooking of bamboo, stock preparation equipment, two cylinder paper machines, and finishing and converting machinery was literally picked up from its original position by the Chinese on the mainland and transported overland to

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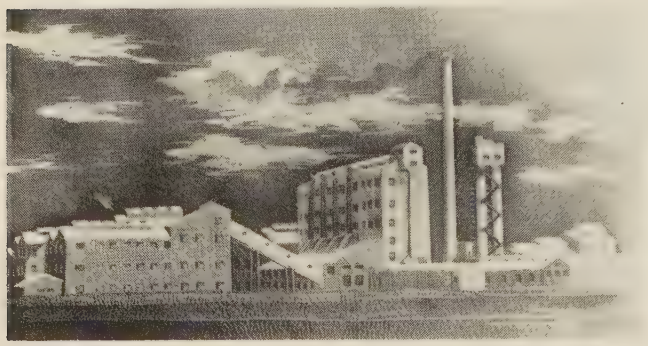
the sea by every conceivable ancient mode of transportation including sections of machine frames strapped to men's backs. Small boats carried the parts across the 75-mile-wide Straits of Formosa to a point near Taipei where it was re-erected and is now manufacturing several weights of kraft paper. The resourcefulness of



Largest bagasse pulp mill in the world at Hsinyin, Formosa. (Taiwan Pulp and Paper Corp.)

the Chinese is extraordinary. The balance of the mills except five, consists of a few handsheet units and small cylinder plants employing pulp made principally from hemlock, pine, bamboo, bark, rice straw, banana fiber, ramie, and grasses, plus a major supply of pulp manufactured in one of the last five mills, namely Hsinyin. This is the largest bagasse pulp mill in the world. Its normal daily output is 80 metric tons. It is located close by a large sugar mill from which the bagasse is taken. This pulp mill, if built today, would cost $10,000,000. This, and the other four mills, are owned and operated by the Taiwan Pulp & Paper Corp. employing a total of 2100 hands. The papers manufactured are newsprint, book, kraft wrapping, bonds, ledgers, writing, bristols, board printing, etc. H. Y. Chao is general manager and K. H. Yu is chief engineer.

The supply of pulpwood is scarce and expensive because of the mountainous terrain of the country. Therefore it is imperative that increased use of bagasse and grasses be encouraged in order to permit timber to be cut for the lumber industry only.

During the war the five mills of this company were severely damaged from Allied aerial bombing because it was suspected that nitrating pulp, to be used in making explosives, was being manufactured by the Japanese. By 1948 repairs to this damage from bombs had been completed and all machinery was in operation.

Taking all the pulp and paper mills collectively, the following statistics give a quick picture of the part these commodities play in the economy of 9 million people (estimates for 1952.)

A program of expenditures of $2,632,000 has been developed by the author for the United States Government to increase production facilities in fiscal years 1953, 1954, and 1955, in order to save American dollars through increasing output of present machinery, and to capture foreign exchange through exportation. Already purchases amounting to $1,220,000 have been made. For example, a 120-in. paper machine is manufacturing newsprint at below 500 f.p.m. After reconstructing the machine with equipment being purchased, this speed will be raised to a range of from 900 to 1000 f.p.m. And so it goes with wrapping, printing, tissue, and miscellaneous papers on other machines where improved production both in quality and quantity will not only match demands but will keep abreast of a

Statistics for Taiwan for 1952 (Metric Tons)

Commodity	*Annual consumption*	*Annual production capacity*	*Annual imports*
Paper			
Printing paper	7,000	9,300	...
Newsprint	3,500	3,500	400[a]
Wrapping and kraft	2,500	2,500	...
Printing	2,600	2,600	...
Poster	3,200	3,200	...
Tissue	1,800	1,500	310
Miscellaneous	3,200	2,760	1450
Totals	23,800	25,360	2160
Paperboard	4,500	5,500	...
Pulp			
Sulphite wood	7,500	7,000	500
Mechanical	3,000	3,000	...
Bagasse	7,000	15,000	...
Kraft	2,250	...	2250
Totals	19,750	25,000	2750

[a] Importation of newsprint temporarily halted.

rapidly expanding economy which today consumes about 6 lb. of paper per capita which the author estimates will amount to approximately 12 lb. by 1960. The rate of improvement in production and consumption will depend upon the availability of electric power. Thermal plants supplemental to the present hydroelectric plants are now being installed.

The most important improvement in operations will be in the pulping of bagasse at the Hsinyin mill referred to above. The present process of sulphite pulping produces dirty, weak, and high cost pulp. The proposed program, now being worked on, will be the application of the mechano-chemical system for pulping this agricultural residue. This system was developed by E. C. Lathrop and S. I. Aronovsky at the Regional Laboratory of the Department of Agriculture at Peoria, Ill. The methods of removal of the pith, which when

A stock pile of bales of bagasse. Hsinyin mill, Formosa

present, is detrimental to the production of good paper from the pulp, is divded into two schools of thought, best described as the wet and dry systems. The author is convinced that the wet system employing the mechano-chemical method using Hydrapulpers is the better. This equipment with special high vaned rotors

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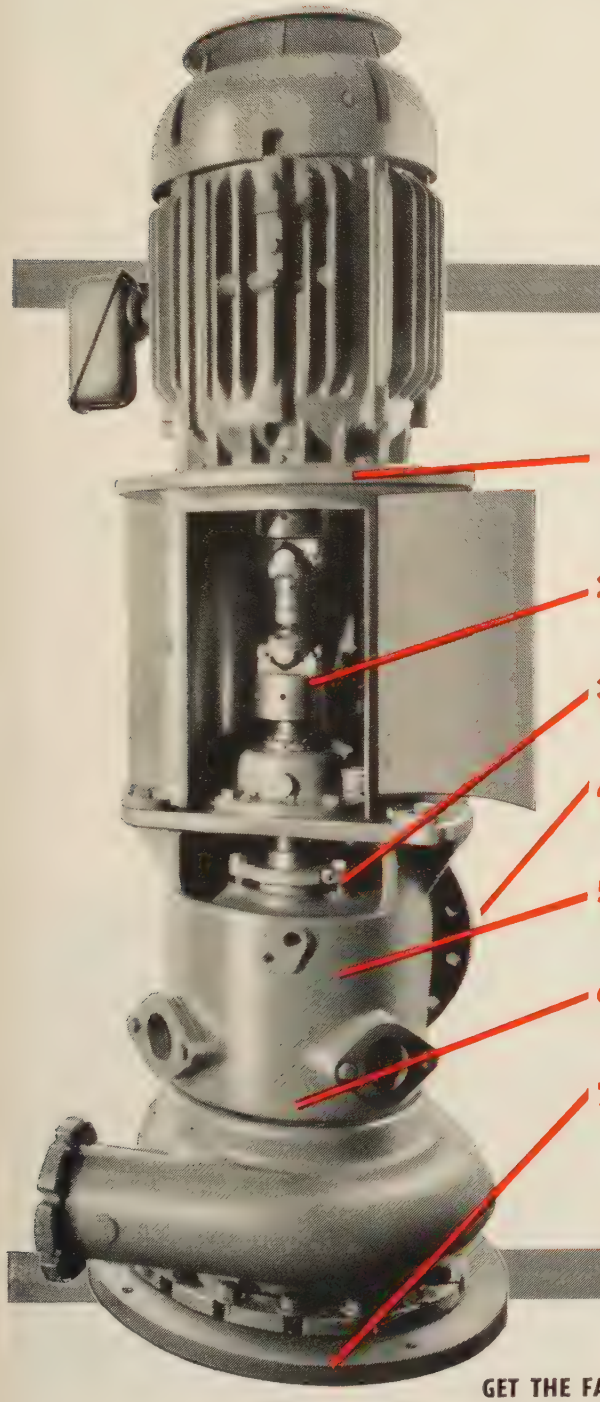

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is used for both pith removal and cooking. The results attained are efficient removal of pith as well as the dirt which goes with it, and improves the strength and should make it competitive to kraft wood pulp laid down at Keelung, the northern seaport of Formosa. This part of the program should be completed by the end of 1955.

Beater at Van Hwa Paper Co. near Taipei, Formosa. L to R: Roland A. Packard, Val de Beausett, resident manager, J. G. White Engineering Corp.; with the mill manager and superintendent

This Hsinyin mill exported bagasse pulp during 1951 when world prices of wood pulp soared out of sight. The repercussions of the "morning after" showed the Chinese papermakers that to export pulp again they must produce not only strong, but clean pulp, and at a price.

At the present time, Karl W. Fries, formerly technical director of the Rhinelander Paper Co. of Rhinelander, Wis., is executing the above pulp and paper program in Formosa as well as a consultant for the balance of the 30 mills on the island.

THE PHILIPPINES

The Philippine Islands have a combined area equal to Kentucky, Tennessee, and Indiana. As you know, these islands have been under the influence of the United States for about a half century. The English language has been taught for many years in the public schools so one finds no difficulty in traveling from place to place with the help of the Filipino people who are very friendly. The Republic of the Philippines took over on July 4, 1946. The ruin of Manila from the ravages of war made it necessary for the United States to launch a program of reconstruction and economic assistance which was supervised by ECA (Economic Cooperative Administration).

The industrial development in the Philippines did not really get under way until after the turn of the century. The islands are prodigiously supplied with natural resources, not the least of which is timber and hemp. The latter is locally known as abaca. There are 1000 commercially valuable types of trees but only 200 had been marketed before the war. The lumber industry is of major dimensions, and strange as it may seem, practically no wood is used to manufacture pulp.

The consumption of paper and board in the Philippines is approximately 75,000 short tons annually, of which about 10,000 tons is manufactured domestically. The author visited two of the three mills on these islands. The Philippine Paper Mills, Inc. is located just outside Manila. It has one small chipboard machine employing 100% furnish of refuse kraft and wastepaper. The author had an opportunity to talk with the president and manager, Alexander A. Adamson. He is a very resourceful gentleman who has continually improved the equipment of his mill. The other mill, 400 miles south of Manila on the island of Negros, is called Compania de Cellulosa de Filipinas. This latter mill is adjacent to a sugar mill and employs a modified Pomilio system of pulping and bleaching, as developed by the Cellulose Development Corp. Sodium chloride is the only chemical purchased. Electrolytically chlorine and caustic soda are manufactured. The expelled hydrogen gas is burned in the presence of chlorine to form muriatic acid which is sold. One 76-in. fourdrinier paper machine makes about 20 tons of writing or bond per day out of 80 to 100% bagasse pulp furnish. The balanced operations of the sugar, pulp, and paper mills are a real pleasure to see. Modern equipment has been installed and operated under efficient management. Of particular interest is the use of fuel oil to generate steam for the operation of steam turbines for electric power for manufacturing in the pulp and paper mill. This affords a greater quantity of bagasse to be employed in making pulp and paper.

The importation of paper and board has been for many years an open invitation for some enterprising party to manufacture approximately 60,000 tons of this commodity using part of the great supply of wood for pulp. The original conception of this project was made nearly 20 years ago by Andre Soriano, a capable and successful industrialist. The war stagnated prog-

Laminating machine Van Hwa Paper Co.

ress, but extensive investigation of raw materials and possibilities for hydroelectric power development finally centered itself on the southern island of Mindanao near its northern tip in the so-called Bislig Bay area below the city of Surigao. Logging and sawmill operations in the Philippines are generally handled on a

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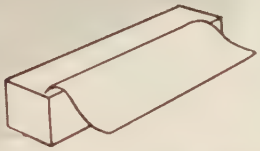

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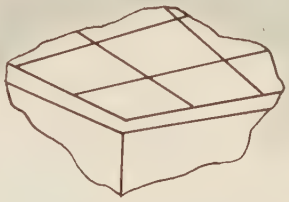

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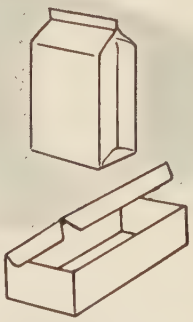

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very inefficient basis with a loss of 50% of the timber. A logging and lumber company now in operation in the above area is a natural, to be supplemented by a pulp and paper mill. Previous to and after the war extensive laboratory tests were made on different woods with the conclusion that the commonly known "lauans" of the dipterocarp family of trees which account for about 70% of timber growth in the Philippines would be best for the manufacture of linerboard, kraft bag and wrapping, newsprint, printing, and writing papers. Where greater strength or better tear becomes necessary, the addition of 10 to 20% of hemp or abaca will produce the required strength characteristics.

The project has progressed to the point of a cooperative effort among private interests, the Philippine Government and the Export-Import Bank of the United States involving a reported $25,000,000.

There are many sound industrial or public works' projects being developed or under construction or both, which collectively, will do their part in raising the economic status of these people.

INDO-CHINA

This country consists of three federated states: Vietnam, Cambodia, and Laos. The combined areas are about equal to that of Texas. The consumption of paper among its 27,000,000 inhabitants is the lowest of the low, namely 0.7 lb. per capita. All of the 10,000 tons consumed is imported because about every dollar or equivalent that can be obtained must be spent for the military, war relief, or rehabilitation. Programs instituted by the United States through FOA include public health, education, improvements in agricultural operations and public works. The nearest item to the manufacture of pulp and paper is forestry, which in some areas has experienced a tremendous expansion; but small as measured against the total economy. Large areas with military insecurity, increase the difficulty of making any kind of industrial progress. One bright spot is that this country is one of the world's richest rice bowls. Saigon, the capital city and main seaport through which harbor passes "the material of freedom" from the free world to a population equal to one sixth of that of the United States. The majority of the inhabitants cherish freedom and wish to do all possible to raise the standard of living and by this means influence people with communistic leanings, to break away from such doctrines and seek stability and liberty in thought and action.

THAILAND

Thailand, though somewhat smaller in area than Indo-China, still is equal to the combined areas of New England, New York, Pennsylvania, and Ohio with approximately 18,000,000 people. This country consumes four times as much paper per capita as Indo-China. This is a microscopic figure when compared to nearly 400 lb. consumed in the United States. It compares with 35 lb. per person used in Japan. The total consumption of paper is approximately 22,000 short tons, of which about 1500 tons is manufactured domestically by private interests. It is reported that Italians are operating the lone paper mill of this country.

It does appear that, on the surface, Thailand is ripe for a new pulp and paper mill to produce newsprint, book, kraft for multiwall bags and wrapping, toilet, and writing papers. Such an operation would save approximately $4,000,000 annually, which would be a help in raising the economic status of the people. It is reported on good authority that the Thai government is interested in the possibilities of additional manufacturing facilities for these commodities. It is further reported that there are several sites where there is an abundance of good quality water for manufacture and even in generous quantities with plenty of head for the generation of electric power. There is little domestic coal but large quantities of lignite. Forests are ample for the supply of pulpwood; but all chemicals would have to be imported, depending of course on the type of pulping which would be used. A very thorough investigation would have to be made to find the best wood to be used for raw material. This would consume at least 1 and possibly 2 years. The author believes FOA, which has done so much to assist the Thai people in improving public health, education, agricultural operations and public works, would give its blessing and cooperation to such a venture. The trouble today is a lack of technical assistance to carry out programs so essential to the welfare of the people to convince them that the democratic way of living is superior even to the glib-sounding promises which are now being made by the Communists to millions of the inhabitants.

To promote such a project, one would find, naturally, politics tied up with well-to-do Chinese importers who would oppose such a move which would cut down their commissions. The only proper approach would be to get one or more rich importers together and explain the greater rewards which should accrue to them in a 60 to 80-ton mill which should produce the commodities on large enough scale to be competitive with the imported items and at a good profit to themselves.

KOREA

Manufacturing activity is more highly developed in Korea than is generally appreciated. Korean output in 1950, prior to the invasion, was essentially from fabricated products, which is in high proportion to the total. This proportion was second only to Japan. However, the scale of enterprise was relatively limited.

There is present today a sound basis for encouragement for reconstruction and for an expansion beyond the 1950 figure; however, large scale manufacturing of consumers' durable goods is not feasible.

An original reconstruction program was developed in the UNKRA (United Nations Korea Reconstruction Agency) fiscal year 1953 program which covered a total of $8,150,000. This amount covered coal briquetting, paper, wire nails, farm tools, textiles, cement, fertilizer, and flat glass production. Along with this program, a loan fund of $1,000,000 has been included. For fiscal year 1954 the expansion program covers additional important manufacturing, including electrical equipment, leather, silk filature, chemical, and automobile tire production.

Newsprint and banknotes, textbooks, bags, and utility paper are being consumed in increasing quantities. This means costly importation of paper and paper products. The production of these commodities

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had reached 8400 metric tons in 1949. During 1950–51 due to the war this figure dropped to 4100 metric tons. For 1952 this figure again rose, attaining the level of 11,000 metric tons, which is below the needs of the people.

UNKRA is now arranging for the importation of machinery, parts, supplies, and construction equipment for the rehabilitation of three South Korean paper mills and sanctioned by the ROK government. The equipment for one of these plants has already been received and procurement of the other two is under way.

The estimated current consumption of all paper and paper products is 18,000 metric tons, which based on an estimated population of 18,000,000 amounts to approximately 2.2 lb. of paper per capita. This yardstick of the standard of living still indicates a low level. The dollar gap is now 1 billion dollars.

What are the prospects of obtaining pulpwood? This is a serious problem because Koreans have cut 50% of all timber since June, 1950, 80% of which has been used for fuel. Singman Rhee at age 76 is back of any practical item which will raise the standard of living of his people. Recently, the author entertained at his home in Washington a friend with whom he had been associated in Formosa, and who had spent 2 years in Korea. He stated that he had had several conferences with the President of Korea, who described to him emphatically that he wanted to build a solid foundation for progress in South Korea in order to show to the North Koreans, when the time shall come, when they shall be permitted to choose their own way of life, the proper pattern to improve the living conditions of the people. Such progress, in addition to that already described, will include improved housing, better public health, advances in education, higher efficiency in raising crops, and progress in public works.

CHINA BEHIND THE "IRON CURTAIN"

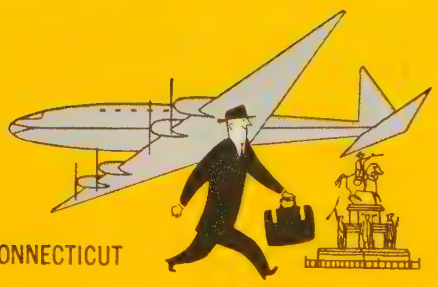
The author was able, while in Formosa, to glean unprinted information about the pulp and paper industry in Red China, but at the same time authentic enough to include in this presentation. In a similar manner, he secured some of the items which were included in his published article "Formosa, a Frontier of Civilization."

There are certain items which we know to be true before the "iron curtain" was dropped and worthy of our attention as a starting point. For example, in spite of the fact that paper was invented on the mainland it seems like a paradox to note that the current consumption of this commodity among the more than 450,000,000 people has not exceeded 2 lb. per capita. But just this figure represents approximately 15 100-ton mills running 300 days annually. This might be considered a sizable industry when compared to the run of countries over the world outside the United States and Canada. However, East-West trade agreements indicate that about one third of this paper comes from such countries as Finland, Poland, Czechoslovakia, West Germany, and even Russia itself.

As is well known, the pulp and paper mill section of the country, like most of the other industrial development, is in and around Shanghai or the northeastern area. The manufacture of pulp and paper is a natural for the Chinese and as a result, anything which has fiber, has been tried out in one or more of the small mills which are scattered over the country. The fast-growing bamboo, rice straw, and grasses are the popular sources of raw material on the mainland. Vast untouched forest areas are an invitation to the Communists who are expanding this industry. Last year a high-level forestry official from Russia met with a group of Europeans in Italy and to a surprising degree collaborated with them in the promotion of forestry activities in both Europe and Asia. Chemicals are manufactured domestically with the importation of at least 30% of the total. Size manufacture is a simple matter. Coolies collect leaves from certain plants which are placed in kollergangs, and the extracted juices are put directly in the beater or size press on the paper machine.

The small mills outside of the handsheet units are always equipped with one or more cylinder machines running at an average speed of 80 f.p.m. A few of the larger mills equipped with fourdriniers have attained a speed of 250 f.p.m. on newsprint.

Electric power in the northeastern area is purchased from public utilities which have several fair-sized thermal plants in and around Shanghai. The mountainous character of much of the country has afforded many waterfalls in rivers, but exploitation of them has been on a small scale because of a lack of capital. Usually an old steam engine is the source of both heat and mechanical power for many of the mills.



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As far as machinery is concerned, the Chinese are very resourceful in the manufacture of some mechanical equipment in small-scale foundries, where cast iron is melted and poured into molds, to be machined on homemade lathes rotated by man or animal power which when stepped up in speed can be sufficient to turn off a thin chip with a crude steel tool. Near Shanghai is a paper machinery manufacturing company which has actively produced fairly modern paper machines of late, copied after their knowledge of what technical visitors to the United States have gleaned over the past 25 years.

CONCLUSION

In conclusion, collective security with other nations both from a military and economic standpoint, is the only sure road to a peaceful future for the United States. Two wars have reduced Great Britain from a creditor to a debtor nation and placed the United States as the greatest creditor nation in the history of the world and with the highest standard of living. Now for the 64 dollar question—can we survive another world war? I am sure all of you agree with me that with such an event we would be set back a hundred years and loss of untold millions of our population.

During the last 15 years whenever our pulp and paper industry has looked forward to an apparently sliding business it has been refreshing for all of us to hear Clark Everest get up on his feet and predict a rosy future. And every time he has been right. Why? Because he has had an indelible impression of the upward slopes of graphs in spite of any dips of pulp and paper consumption from the turn of the century, when there was but a small fraction of these commodities used compared to that which now obtains. Now, we have more babies and old folks at a greatly increasing trend, all of whom, with others, want more and more paper. Therefore, any decline in orders on the books of any well-operated pulp or paper companies is bound to be temporary. These are the perennial thoughts of Mr. Everest.

Every nation needs some of the commodities manufactured in the United States. The only way they can acquire them is to earn dollars to pay for them. We can buy what they have to sell if we will acquire it on a slowly increasing scale; so as the American economy continues to expand, and the author is one who believes that it will, then we will continue to sell more in both American and foreign markets, working on a trend of a gradually higher standard of living over the earth.

The pulp and paper industry is an important segment of this picture, not only because it is essential in any program of any nation in raising the economic status of the people but, also because it can be bought in either small or large quantities in contrast to the purchase of consumer's durable goods so often with a unit cost far beyond the pocketbook of untold millions in foreign lands.

Any way you may look at the slogan "Trade, Not Aid," you will find yourself in an argument with someone. As you know, aid by our government has been cut drastically. Still greater cuts undoubtedly will come for fiscal year 1955, which will start next July first. Much of this argument may be due to mill executives placing too much emphasis on currently narrowing profits and what they feel they may expect in the immediate future, and not enough emphasis on long range prospects.

The Randall Committee report, recently given to President Eisenhower, has come up with the best suggestions so far. Among other items, one, the gradual cutting of import duties which to the author means, as we in the pulp and paper industry make technological improvements and can correspondingly cut costs. Two, further encouragement for private investment abroad which has been rightfully cautious because of the risks of military strife and certain laws in foreign countries discouraging such moves. To be added to this item is preferential tax treatment. Lastly, three, United States and several other nations to provide the necessary technical help to undeveloped countries.

Finally, the author, a past executive in a pulp and paper mill for a great many years coupled with extensive industrial experience with the peoples of foreign lands, feels that for the ultimate selfish good of every American and descendants that we must collaborate with the peoples of other nations to enable them to make and export a variety of commodities for the collective good.

RECEIVED Jan. 28, 1954. Presented at the 39th Annual Meeting of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 15–18, 1954.
The following men have checked items: Joseph E. Atchison, F. M. Kraus, Karl A. Clauson. Three photographs and some stat stics supplied by Arnold J. Barea.

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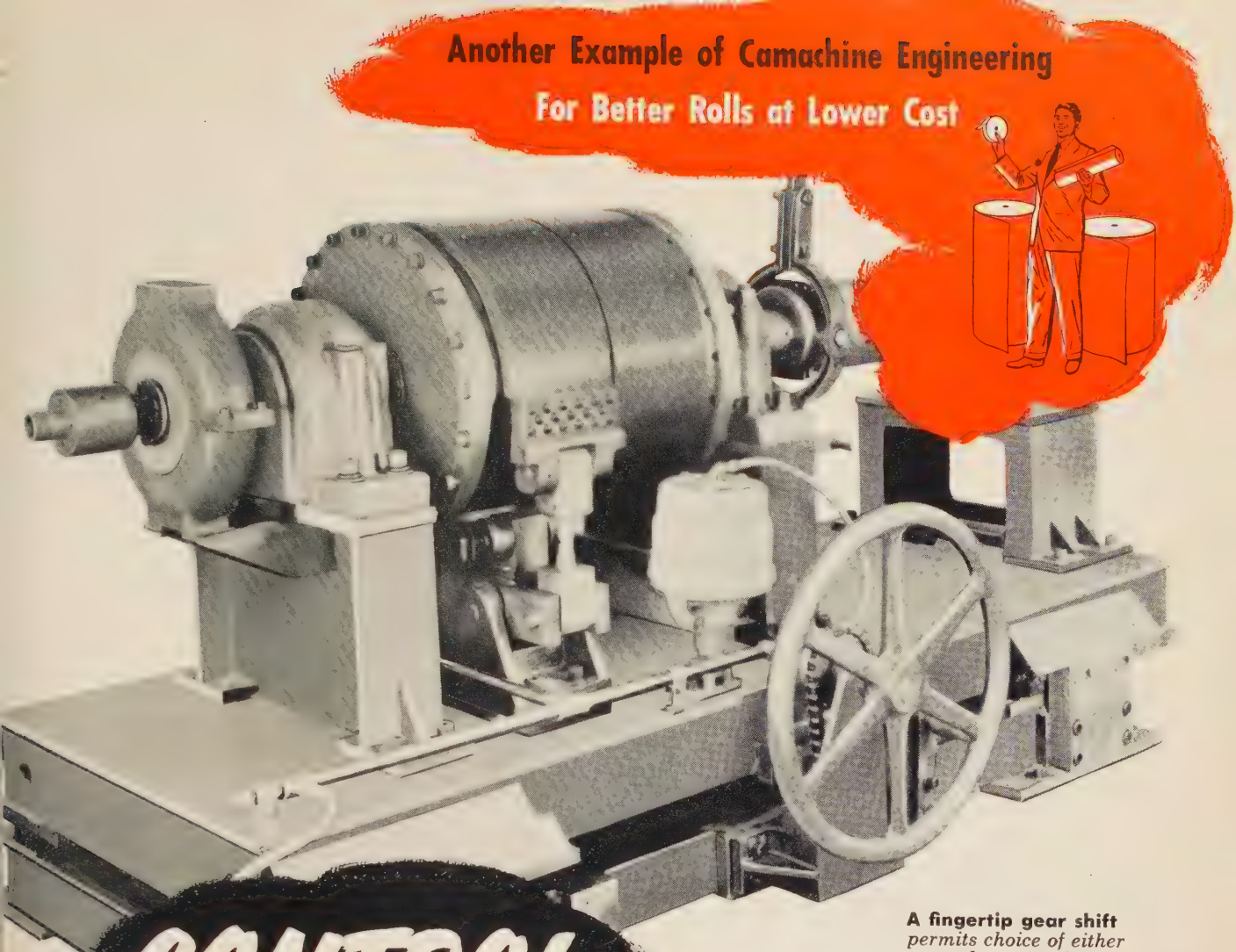

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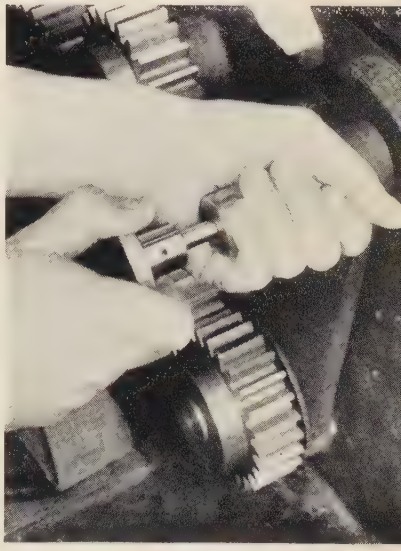

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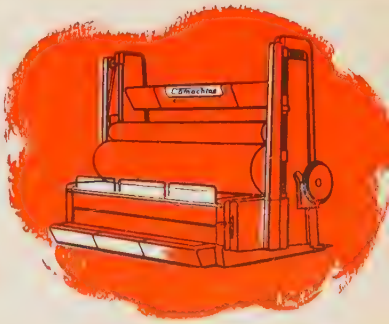

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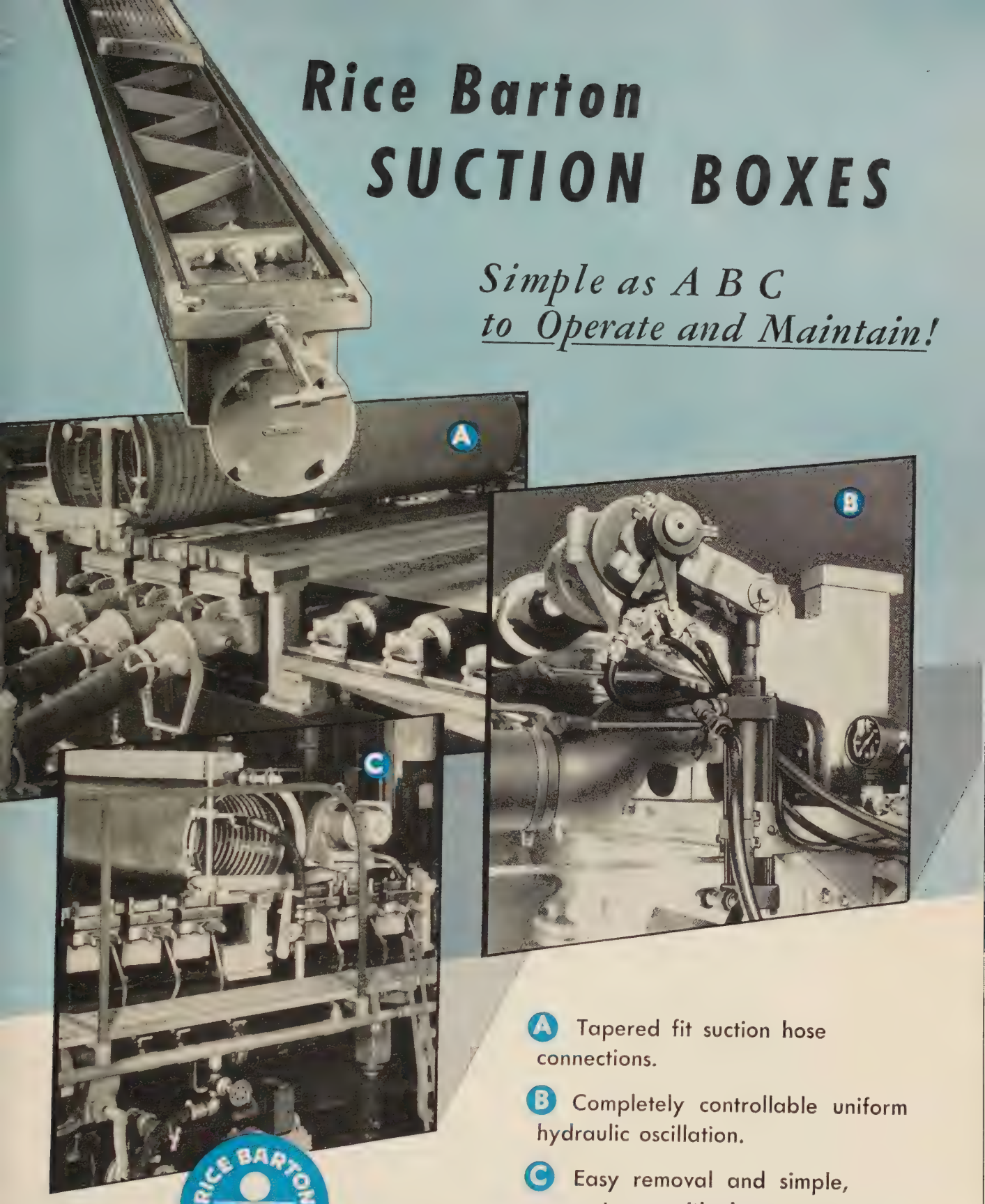

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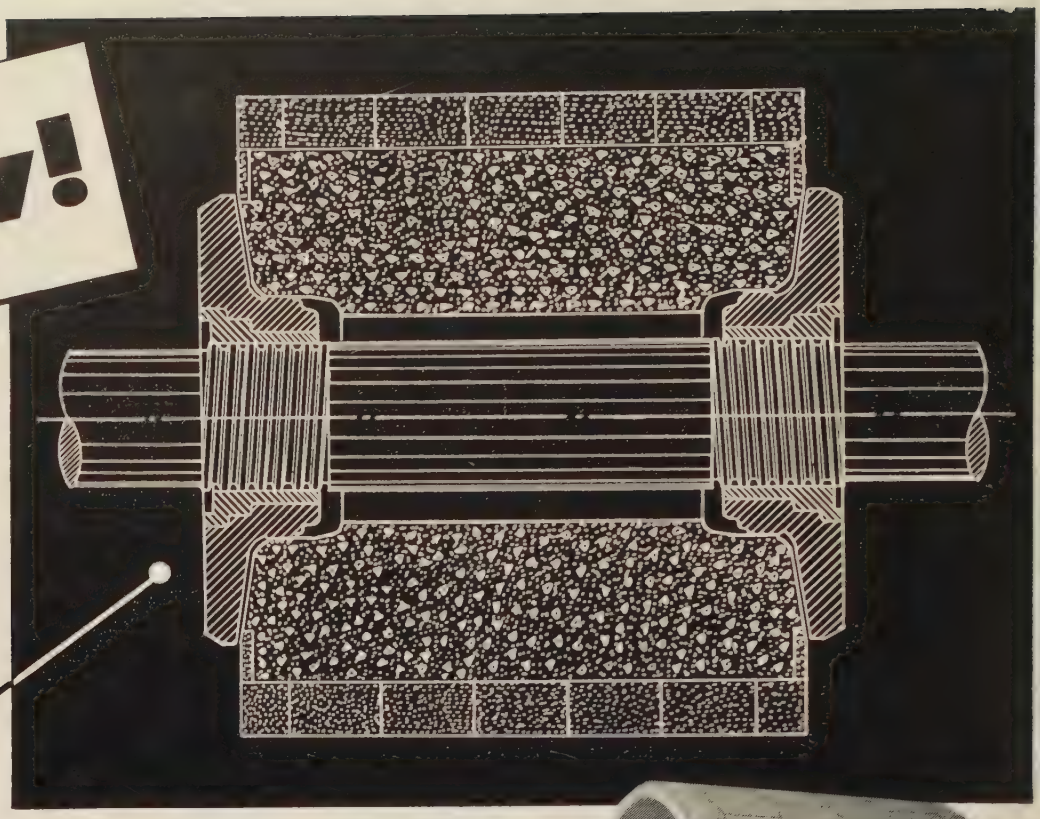

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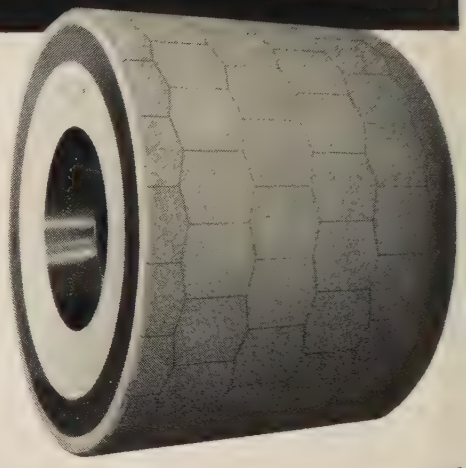

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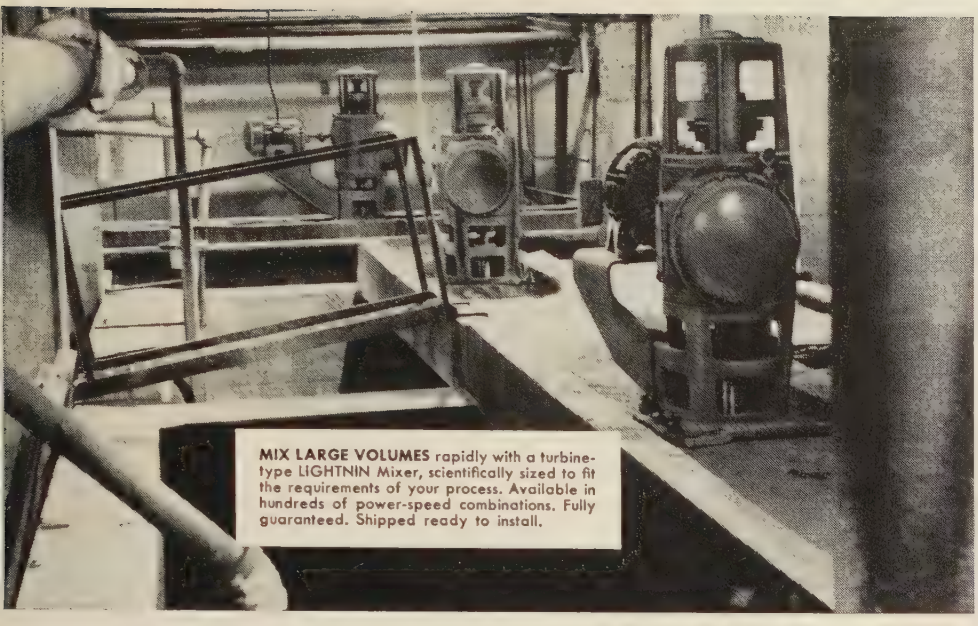

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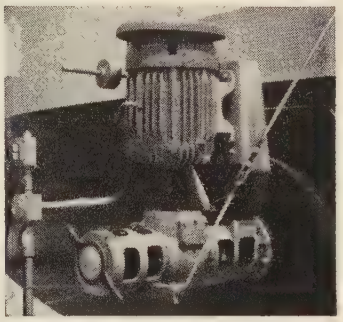

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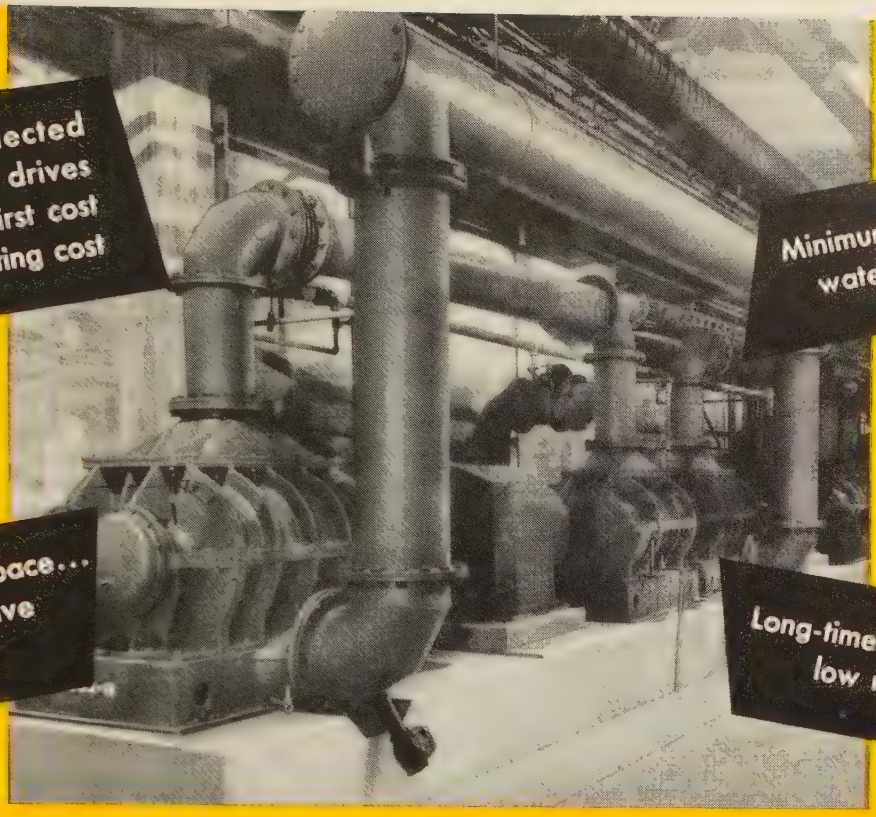
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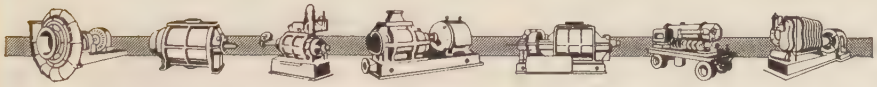

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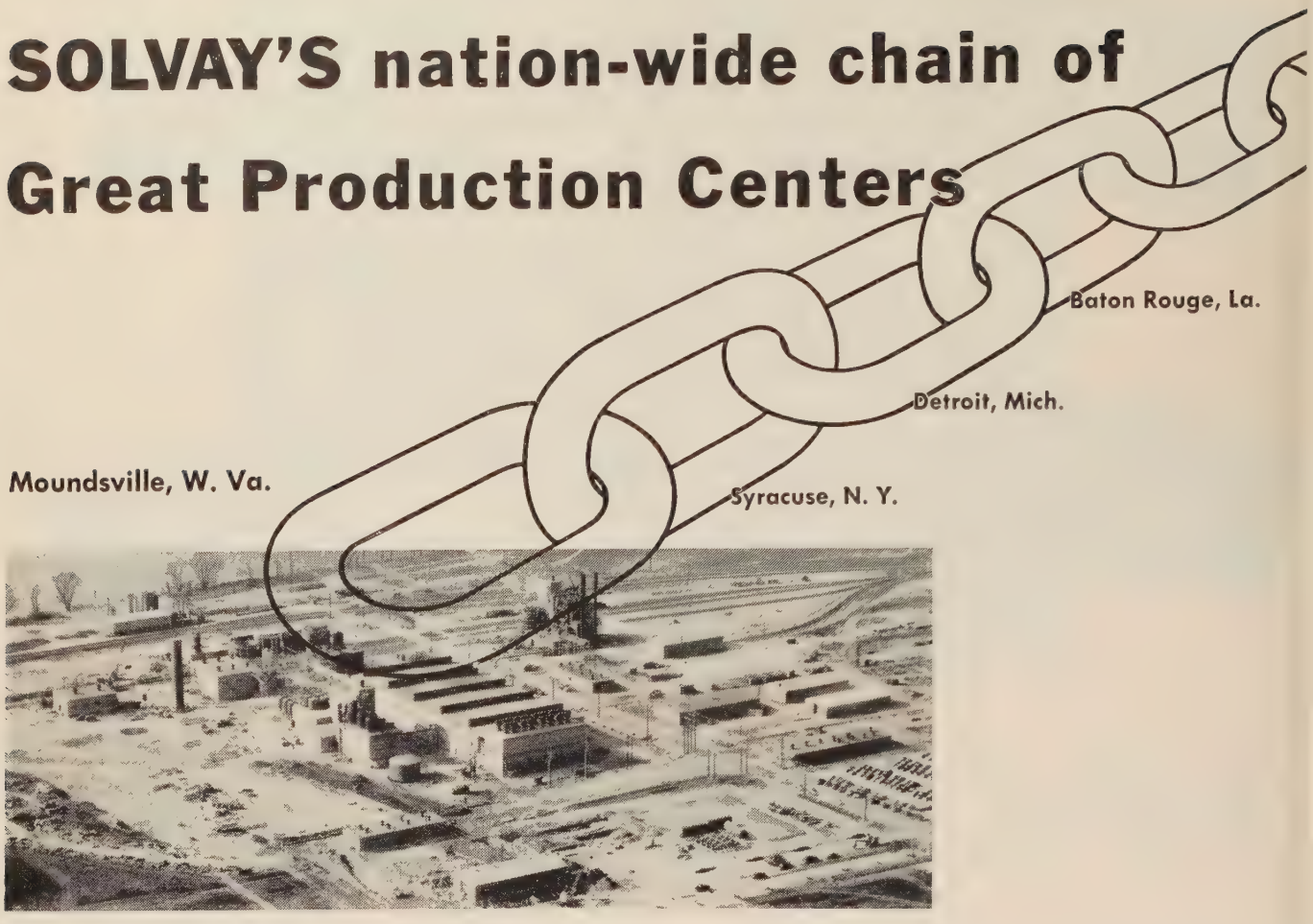

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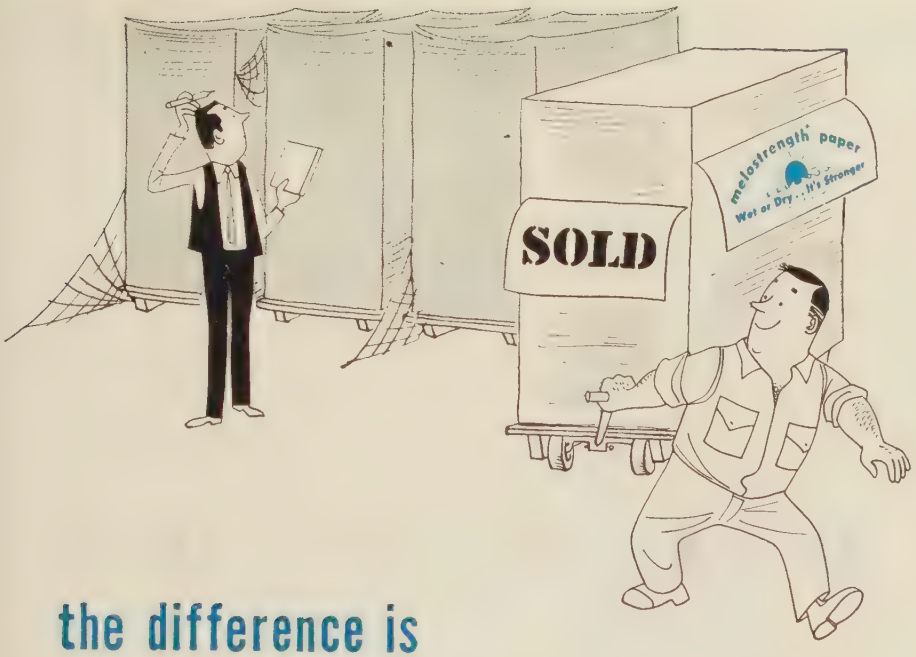

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Recent Mill Developments with Cyanamid Paper Chemicals...

BETTER SHEET FORMATION is credited to ACCOCEL® 741 when added in very small amounts to the breaker beater, according to an Indiana mill. The mill reports better disintegration of fiber bundles and improved dispersion and distribution of rosin size.

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IMPROVED RETENTION OF FINES is another "plus" scored with Sodium Phospho Aluminate. This is especially important in mills where the white water system is not a closed system and considerable fines would ordinarily be lost in the discharge of waste water. Prevention of stream contamination is also a potential benefit.

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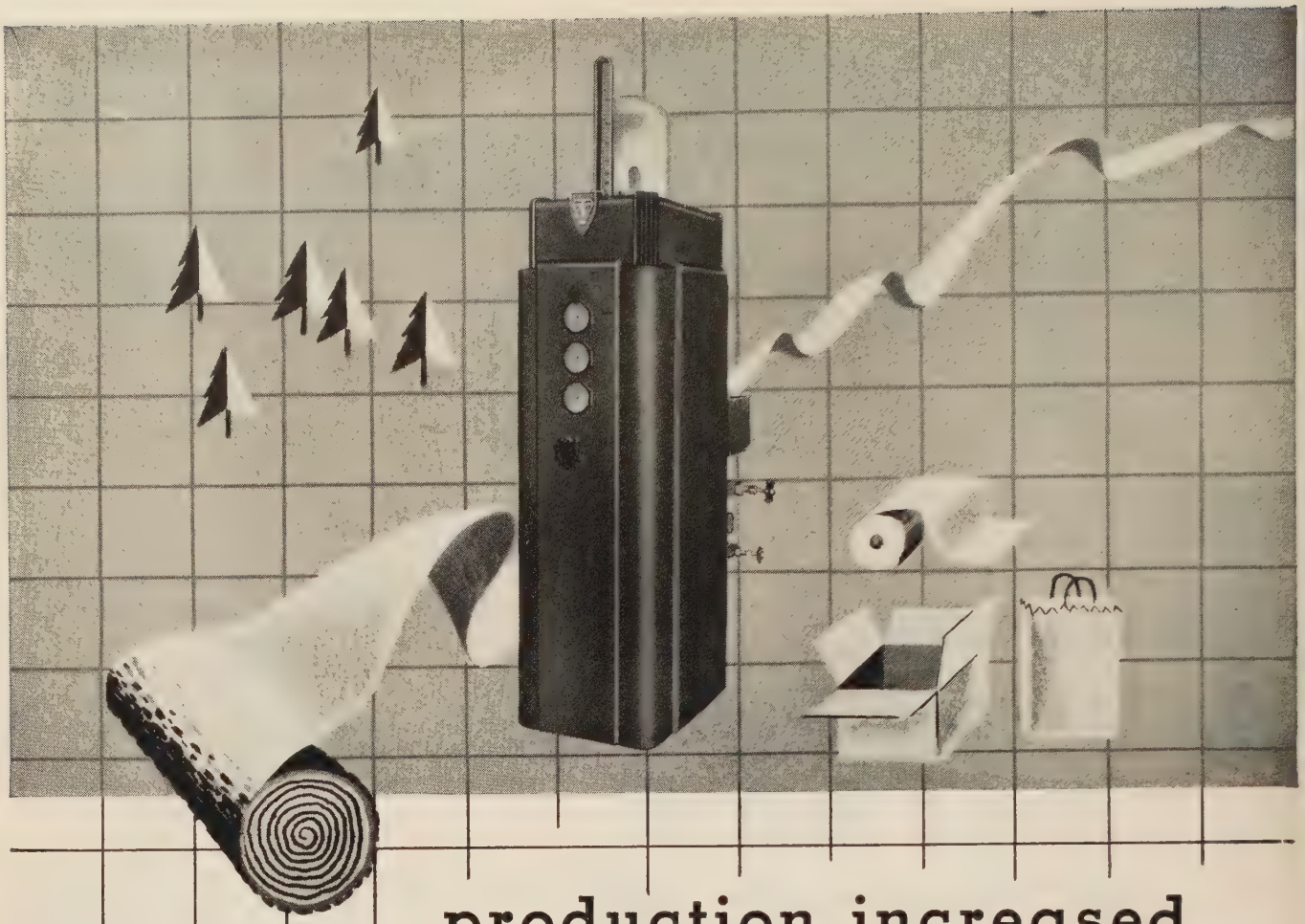

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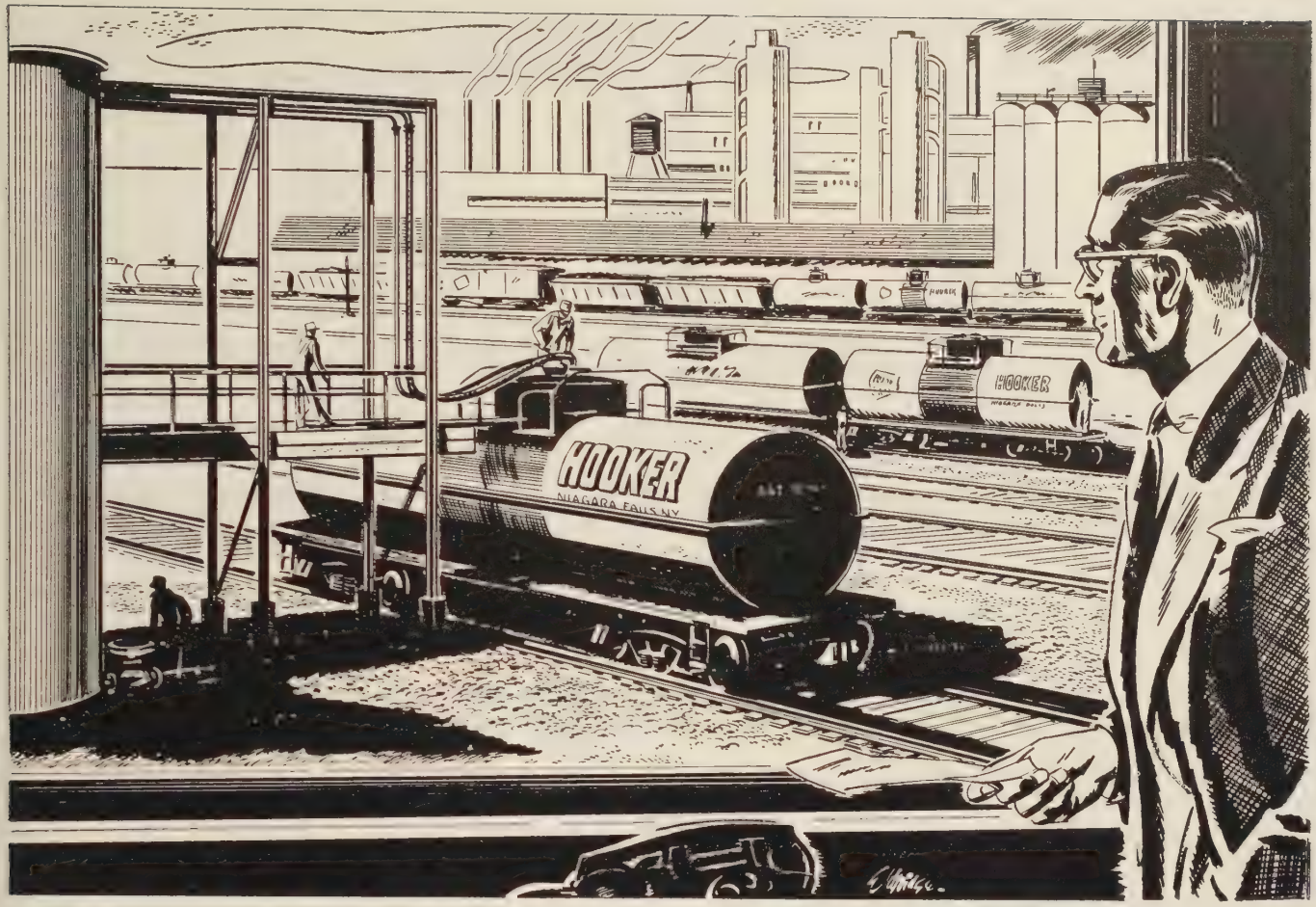

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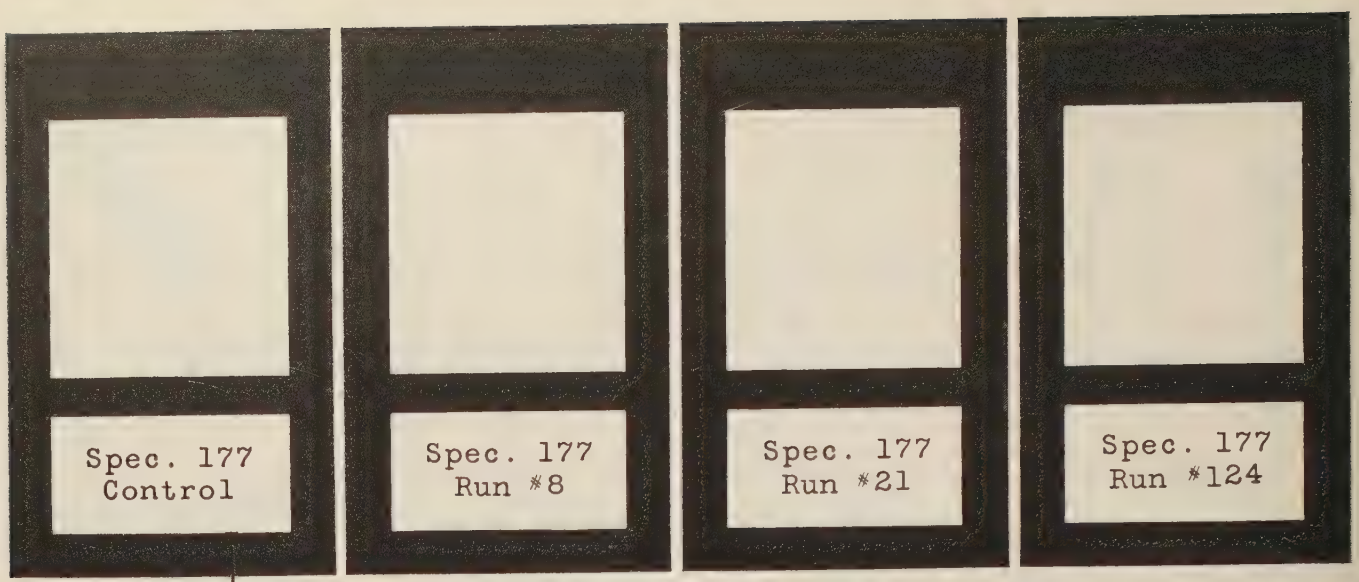

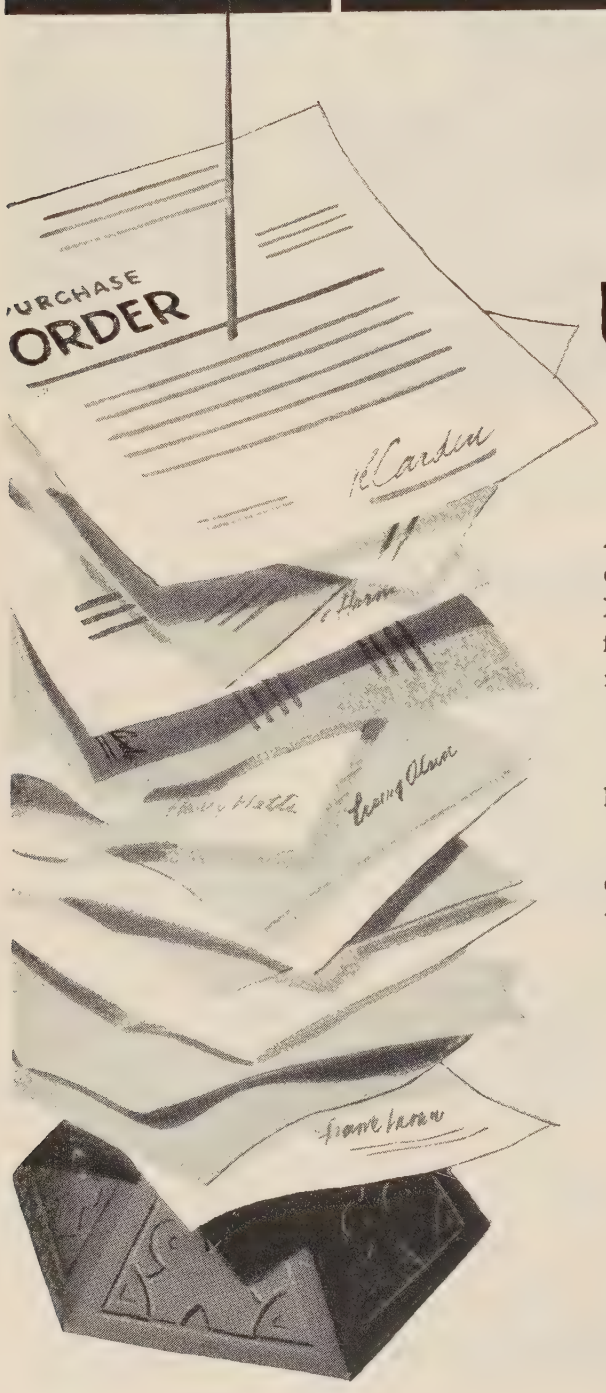

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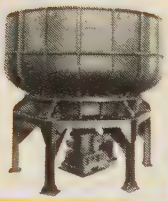

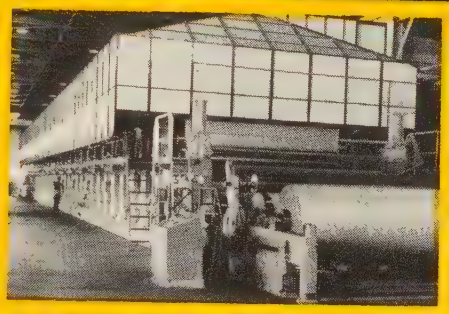

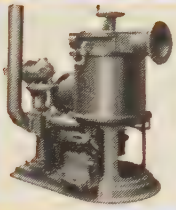

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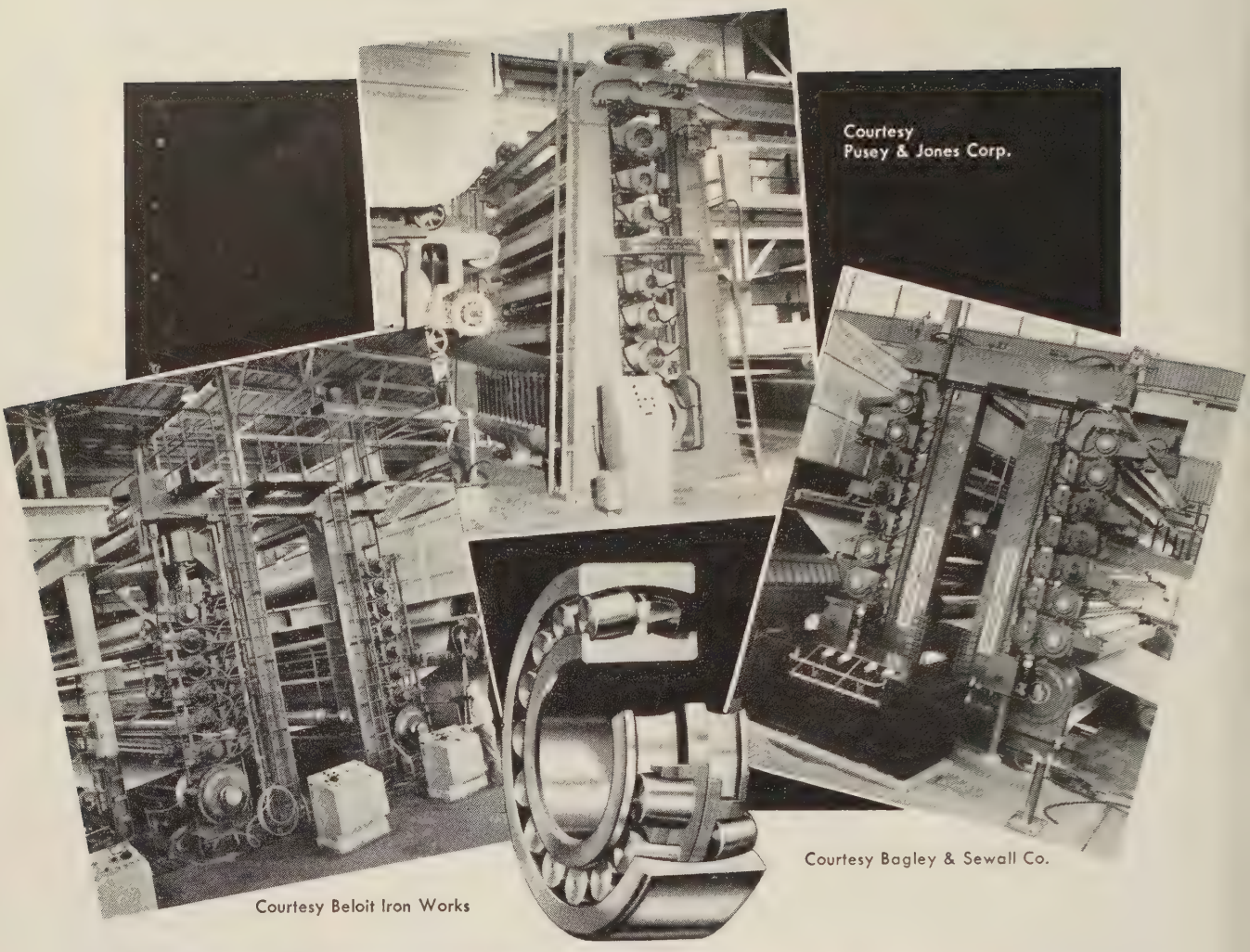

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PULP DIVISION WEYERHAEUSER

Electric Wire and Cable Recommendations for the Pulp and Paper Industry

A. O. MORTENSON

This report summarizes the recommendations of the TAPPI Cable Subcommittee on the selection of wire and cable for the pulp and paper industry.

THIS report summarizes the recommendations of the TAPPI Cable Subcommittee on the selection of wire and cable for the pulp and paper industry. The committee comprised authorities in the field of wire and cable, representatives of the Insulated Paper Cable Engineers Association (abbreviated as IPCEA), cable manufacturers, and operators of both American and Canadian mills. The committee made an exhaustive survey of the paper industry in 1951 and 1952 to learn of cable service experience, operating conditions and requirements, installation methods, etc. for guidance. Exposures and other requirements peculiar to the paper industry were carefully reviewed and fully discussed. The committee recognized the fact that installation practices vary and, therefore, the recommendations include four of the most common methods of installations.

Wire and cable recommendations covering practically every department and service in the industry are included. Adoption of these recommendations is expected to do much toward assuring the pulp and paper mills maximum service for their wire and cable installations and assist in unburdening the electrical engineers of the industry faced with all the decisions involved in a wiring program of any consequence, be it construction of a new plant or extension or renovation of an existing one.

These recommendations apply generally to both American and Canadian mills; one exception, pertaining to paper-insulated cables peculiar to some Canadian mills, is discussed separately.

BASIS OF RECOMMENDATIONS

The selection of cable should be based on: (1) the proper insulation, (2) type or method of installation, (3) over-all reliability of the power-distribution system, and (4) cost.

Continuity of power so vital in the paper industry may be only as reliable as the weakest link; experience and service records have shown that the weakest parts have been the cable terminations such as potheads. Because of this, dual cable circuits were often required thus increasing the cost of the entire power system and adding to operating complications.

The present trend for improved reliability is toward cables not requiring potheads such as synthetic rubbers and varnished-cambric interlocked-armored cables. With the elimination of potheads the trend is toward the simple radial-type distribution system which costs less and is much simpler to operate. Thus, the cable selection is an important factor in the over-all cost of the distribution system; what may be the lowest cost cable may not result in the lowest cost power system.

The following application tables show the recommended cable selection in terms of areas, exposure, voltage classes, and installation methods. All of these cable types have been proven in paper mill service and are commercially available from manufacturers.

The number of alternative selections was purposely limited in keeping with a practical approach. Also, it should be noted that the types of cable for an entire mill reduce to only a few; this is true because many cable insulations are applicable for a variety of exposures; e.g., wet, and various chemicals, liquors, etc.

Even though these tables do not include every area for every type of paper mill it is believed that by comparing the actual exposure conditions with those in the tables the proper cable can be selected.

The use of these tables and data must be tempered with practical realities; e.g., even though a specific area may be "dry," yet if the cable runs through say a liquor, chemical, or wet area the cable should be selected for the most adverse conditions.

USE OF IPCEA CABLE SPECIFICATION

The adoption of cable specifications as TAPPI Standards was considered but dropped because it would be impractical for TAPPI to maintain such specifications up to date. The committee recommends that the

Table I. TAPPI Cable Recommendations—Key to Classes of Cable Designs for Various Installation Conditions

Cable type	*Cable description—general*
1	Heat and moisture-resistant rubber insulation with neoprene sheath
2	Polyvinyl chloride insulation (PVC)
3	Varnished cambric insulation, PVC jacket with interlocked armor[a]
4	Varnished cambric insulation, with lead sheath and neoprene or PVC hose jacket[b]
5	Ozone-resistant rubber[c]
6	Asbestos varnished cambric with lead sheath and hose jacket[d]
7	Mineral insulation
8	Manufacturers' recommendations

Note: All cables to be manufactured in accordance with latest applicable IPCEA Specs.

[a] The armor may be made of galvanized steel, bronze, or aluminum to be used as follows: galvanized steel—dry locations only, no chemical fumes; bronze—exposure to atmospheres containing liquors, chlorine, alkali; aluminum—exposure to sulphur compounds, moisture.

[b] Wherever varnished cambric lead is listed, paper-insulated lead-covered cable with proper hose jacket may also be used if competent cable splicers are available.

[c] For applications above 3000 v., shielding is required; below 3000 v. shielding is optional.

[d] For dry locations, lead sheath and hose jacket may be replaced by an asbestos braid.

A. O. MORTENSON, Chairman, Subcommittee on Cable; Chief of Power, Maintenance & Planning, St. Regis Paper Co., Kraft Paper Div., Cantonment, Fla.

industry follow the specifications set forth in the IPCEA Specifications.

Industry as a rule does not buy cable on individual specification; generally all that is necessary is to state that the cable "... be in accordance with the latest applicable IPCEA Specifications."

DIFFERENCES IN AMERICAN AND CANADIAN PRACTICES IN USE OF PAPER-INSULATED CABLES

It will be noted in the application tables that paper-insulated cable is not included.

Although paper is an excellent cable insulation it requires extreme care in making proper terminations and splices. It is this termination problem—i.e., the lack of trained personnel to make joints properly—that has led American industry to avoid paper cable. This is in contrast to some Canadian mills who have the trained personnel and who have had good experience with paper-insulated cable.

If properly installed paper-insulated-leaded cable can be used in the same areas, exposure conditions, and installation methods listed for varnish-cambric-leaded cable.

The committee recommends that leaded cables have a hose jacket over the lead to prevent electrolysis, or chemicals from damaging the lead.

Table II. TAPPI Cable Recommendations—Nature of Installation Conditions and Cable Recommendations for Same

Area	*Nature of exposure*	*Exposure index*	*Operating voltage*	*Method of wiring installation*		
				Conduit or underground duct	*Aerial cable*	*Open racks, trays, troughs*
Acid making plant	Moisture, acid	BC	Below 600	2 (1, 4)	2 (1, 3)	3 (2, 1)
			Above 600	5 (4)	5 (3)	3 (5)
Bleach plant	Chlorine, sulphur, steam	CE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Boiler room	Dry, heat	AD	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Causticizing	Lime, liquors, steam	CE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Chip preparation	Outdoor—wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
	Indoor—dry or wet	B	Above 600	5 (4)	5 (3)	3 (5)
Chlorine plant	Chlorine	C	Below 600	2 (1, 4)	2 (1, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Coating	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Control room	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Digester	Steam, liquors, turpentine	CE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Evaporator (liquor)	Steam, liquors	CE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Filter room (fresh water)	Wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Finishing, converting	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Grinder room	Wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Hemp cooking and washing	Wet, liquors, steam	BCE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Lime recovery and evaporators	Wet, caustic	BC	Below 600	2 (1, 4)	2 (1, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Machine room (paper)	Wet, steam	BE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Machine shop	Cutting fluids, oils	C	Below 600	2 (1, 4)	2 (1, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Office buildings	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Pulp decker, screen, and washer	Wet, liquors, steam	BCE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Rag bleaching	Chlorine, steam	CE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Rag cooking and washing	Wet, steam liquors	BCE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Rag preparation	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Recovery boiler	Heat, liquors	CD	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Stock preparation	Wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Sulphur burner	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Turbine room	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	1 (2, 3)
			Above 600	5 (4)	5 (3)	3 (5)
Wastepaper cooking	Wet, steam	BE	Below 600	1 (4, 6)	1 (3)	3 (1, 6, 7)
			Above 600	5 (4)	5 (3)	3 (5)
Wastepaper cutting and storage	Dry	A	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Wet machine room (thickeners)	Wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Wood room	Wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)
Woodyard	Outdoor, wet	B	Below 600	1 (2, 4)	1 (2, 3)	3 (1, 2)
			Above 600	5 (4)	5 (3)	3 (5)

Note: Number not in parentheses, is preferred construction per Table I. Numbers in parentheses are alternate permitted constructions.
Index Key: A, dry; B, wet; C, acid, caustic, liquors; D, high temperature; E, steam.

D.C. APPLICATIONS

The committee suggests that the same types of cables be used for d.c. applications as listed for a.c.; the evidence available regarding operating experience for d.c. service did not indicate that any special cables were necessary.

SELECTION OF CABLE FOR GROUNDED-NEUTRAL AND UNGROUNDED-NEUTRAL SERVICE

Cables for service voltages above 5 kv. are available for either "grounded-neutral service" or "ungrounded-neutral service"; i.e., applicable to grounded neutral or ungrounded power-distribution systems.

Most paper mills with voltages above 5 kv. have a grounded-neutral system and therefore can use the cable for grounded-neutral service. Such cable costs less (at 13.8 kv. the savings are in the order of 20 to 40%) and is smaller in diameter thus requiring smaller conduits with an additional installation saving.

The IPCEA definition of a grounded system for cable application is "A circuit is considered to have a grounded *neutral* if the neutral is permanently connected to earth and if facilities are provided to insure prompt isolation of a faulty element of the circuit."

ALUMINUM CONDUCTORS

These cable recommendations are based on copper as the conductor element. Aluminum could be used; it is lighter in weight, but larger in diameter for the same current capacity.

The committee makes no recommendations regarding aluminum conductors because of the apparent lack of knowledge in the industry regarding acceptable and proved terminations.

INDUSTRY TRENDS AND PRACTICES

There are several pronounced trends which should be of interest to the industry:

1. Open Cable Installations: Use of open wiring methods with trays, racks, baskets, etc. in the interest of lower cost, convenience in changing, adding, or repairing cable circuits, taps, etc.
2. Installations Above Ground: Due to the difficulty of keeping conduits and ducts free of water, chemicals, and liquors cables are being installed above ground; generally, the installed cost is less also.
3. Use of Braided Cable Is Decreasing: The use of braid is discouraged because it rots and disintegrates.
4. Rubber-Insulated Cables: These cables have excellent insulation and chemical resisting qualities; potheads, a source of trouble, are not necessary except for outdoor terminations.
5. Interlocked-Armored Cables: The armor offers mechanical protection so conduit isn't required; the installed cost is low (up to 30% less than a conduit installation) and except for outdoor locations potheads are not required for terminations.
6. Aerial Cable: Used especially for long outdoor runs such as filter plant, pump house, etc.

TAPPI Engineering Division Project no. 369, adopted at Montreal, Que., Oct. 27, 1953.

The Cable Subcommittee is greatly indebted to the Insulated Power Cable Engineers Association. We are especially grateful to: E. W. Davis, Simplex Wire & Cable Co., Cambridge, Mass.; R. C. Graham, Rome Cable Corp., Rome, N. Y.; M. H. McGrath, General Cable Corp., Perth Amboy, N. J.; S. J. Rosch, Anaconda Wire & Cable Corp., Hastings-on-Hudson, N. Y.; R. G. Sturdevant, United States Rubber Co., Bristol, R. I.; G. W. Zink, Habirshaw Cable & Wire Div., Phelps Dodge Copper Products Corp., Yonkers 1, N. Y.; Shelby C. Cooke, General Electric Co., Schenectady, N. Y.; John Hogan, The Okonite Co., Passaic, N. J.; R. B. McKinley, General Electric Co., Bridgeport, Conn.; W. C. Warr, General Cable Corp., Perth Amboy, N. J.; D. A. Silver, General Cable Corp., Perth Amboy, N. J.

We are also indebted to the Canadian Pulp and Paper Association for their assistance, particularly to John Eyton, chairman of their Electrical Engineering Committee, for the assistance he has rendered, also R. H. Andrews of the Canada Wire & Cable Co., Ltd. Walter Bloomquist of the General Electric Co. and Oliver A. Smith of the St. Regis Paper Co. should come in for special mention because of the immeasurable help they gave the subcommittee.

Brown Stock Washing Efficiency

Displacement Ratio Method of Determination

J. K. PERKINS, H. S. WELSH, and J. H. MAPPUS

The washing accomplished by the showers on the multi-stage countercurrent rotary vacuum filter brown stock washing system can be expressed as a ratio of the actual reduction of soluble solids across the shower zone of each stage compared to the maximum possible reduction. These ratios, termed "displacement ratios," are a function of the dilution factor and, within the normal operating range, are independent of other variables except pulp characteristics and specific loading. By using these ratios in a stepwise material balance, the washing can be expressed by a single equation: $S_m = \Pi R(1 \rightarrow m)S_b$; where S_m is equal to the per cent soluble solids in the liquor leaving the system with the washed pulp; S_b is the per cent soluble solids in the blow liquor and $\Pi R(1 \rightarrow m)$ is the product of the solids reduction ratios of each of the stages.

THE purpose in introducing the concept of the "displacement ratio" at this time is to present to the industry a new procedure to promote a better understanding of the science of countercurrent washing of pulps. These concepts have aided in the analyzing of *one* three-stage system, and it is hoped that the publishing of these methods will arouse the interest of other members of the industry, who will in turn gather certain necessary empirical data required for different pulps so the methods can be used directly for all types of pulp washing.

Examination of these procedures will also promote a better understanding of the effect of many controllable variables of pulp washing and will lead to better production efficiency.

BACKGROUND

The general effects of most of the washing variables are known—that is, distribution of stock on the filter, feed consistency, vat consistency, dilution factor, shower

J. K. PERKINS, Sales Engineer, Improved Machinery, Inc., Nashua, N. H.; H. S. WELSH, Chemical Engineer, West Virginia Pulp & Paper Co., Covington, Va.; and J. H. MAPPUS, Chemical Engineer, West Virginia Pulp & Paper Co., Charleston, S. C.

SYMBOLS AND DEFINITIONS

D = dilution factor in pounds of liquor† entering a stage per pound of moisture-free pulp

$D.R.$ = displacement ratio

R = solids reduction ratio

$R_1 = \frac{S_1}{S_b} =$ per cent soluble solids in liquor leaving the first washer with the sheet / per cent soluble solids in undiluted blow liquor

$R_2 = \frac{S_2}{S_1} =$ per cent soluble solids in liquor leaving second washer with the sheet / per cent soluble solids in liquor leaving first washer with the sheet

$R_m = \frac{S_m}{S_{m-1}}$ = final stage R factor

$R_b = \frac{W_b}{W_p}$

$R_e = \frac{W_p}{W_e}$

R_{gm} = shower liquor in sheet from washer/total shower liquor, where m is the stage designation; must be figured for each stage

$= R_s \left(\frac{S_v - S}{S_v - S_s}\right)_m = \frac{W_s}{W_{ts}} = R_s\,(D.R._m)$

$R_s = \frac{W_p}{W_{ts}}$

$R_v = \frac{W_p}{W_v}$

$\Pi R_{(1 \to m)}$ = product of R from R_1 to R_m

S = per cent soluble solids in sheet leaving stage (any given stage)

S_1, S_2, etc. = per cent soluble solids in liquor with pulp leaving a given stage, (first, second . . .)

S_a = per cent soluble solids in liquor with pulp leaving any intermediate stage "A"

S_b = per cent soluble solids in undiluted blow tank liquor

S_e = per cent soluble solids in liquor to evaporators

S_m = per cent soluble solids in liquor with pulp leaving final stage*

S_s = per cent soluble solids in shower liquor (any given stage)

S_v = per cent soluble solids in vat liquor (any given stage)

W = weight of liquor in pound per pound of moisture-free pulp

W_f = original weight of vat liquor in sheet

W_{fn} = weight of vat liquor with the pulp leaving the washer at solids $S_v\%$

W_p = total weight of liquor with the pulp leaving the washer at solids $S\%$

W_s = weight of shower liquor with the pulp leaving the washer at solids $S_s\%$

W_{ts} = weight of total shower liquor at solids $S_s\%$

temperature, drum speed, sheet thickness, specific loading, etc., but without a means of expressing the amount of washing done on a single stage of a multiple system it has been impossible to correlate these effects directly with the soluble solids removal efficiency.

Much of the previous study of washing was done on an over-all material balance basis by taking samples of the blow liquor, liquor to the evaporators, and liquor in the pulp leaving the system; and from these data calculating a liquid and soluble solids balance which gave the performance of the entire system in terms of the per cent solids removed for a given amount of dilution water entering the system. This method is valuable for a complete system, but will not indicate how this removal is accomplished on each individual stage of a multistage system (*1*). The calculations for these material balances are tedious and involve trial-and-error methods. These calculations also require an assumption of the amount of soluble solids removal accomplished by each stage (*2*), an assumption which may give misleading results.

At a Southern pulp and paper mill making pulp for paper and board, a study was conducted of the individual stages of a three-stage countercurrent sulphate washing system (*3*) with a view toward determining the amount of washing accomplished by each step in the washing process. This approach led to the derivation of a series of equations (called solids reduction ratios), whereby it was possible to calculate the efficiency of an entire system by knowing the work done by each stage within the system. In this presentation the derivation of the formulas expressing the efficiency term for countercurrent vacuum washers using a single wash liquor on each drum will be reviewed. (*Note:* This procedure requires the sampling of the sheet following application of each strength of liquor.)

As pointed out, this is a new concept of determining brown stock washing efficiency and will require time to prove its over-all practical application. At its present degree of development it appears that the formulas may be used to forecast washing efficiency accurately, and to predict the effects of a change in dilution factor, the addition of another stage of washing, changes in vat and discharge consistencies, etc. In addition, this method of washing analysis offers a rapid and practical means of locating poor operating procedure.

DEVELOPMENT OF THE DISPLACEMENT RATIO TERM

The washing accomplished by a countercurrent system can be considered the result of two operations: (1) dilution of the stock in the vat and subsequent thickening on the filter drum; and (2) displacement of the vat liquor with shower liquor on the filter drum at constant consistency. As it was believed that the latter operation is affected by operating variables, it was necessary to develop a means of measuring the shower efficiency in order to evaluate the effect of operational variables.

By expressing the washing accomplished in terms of the reduction in soluble solids, a measure of the efficiency of the showers is the actual reduction in solids compared to the maximum possible reduction. Consider a single-stage system with soluble solids $S_v\%$ in the vat liquor, $S\%$ leaving in the pulp, and $S_s\%$ applied with the showers, and the sheet leaving the washing stage, with W_p lb. of liquor per lb. of pulp; the maximum possible reduction in soluble solids by the showers is $W_p(S_v - S_s)$, which would mean that all the vat liquor had been replaced by shower liquor. The actual reduction in soluble solids will be $W_p(S_v - S)$. Thus, $S_v - S$ divided by $S_v - S_s$ is the ratio of the actual

† All calculations are based upon oven-dry or moisture-free pulp and the dilution factor defined here refers to pounds of liquor per pound of moisture-free pulp, whereas Klein (*1*) and Swartz (*2*) refer to pounds of water per pound of air-dry pulp. (Final showers $S_3 = 0$.)

* In all the calculations in this presentation Sm is the percentage of readily soluble solids in the liquor with the pulp leaving the final stage. In order to determine the total loss of inorganic chemical it is necessary to know the relationship between organics and inorganics in the black liquor solids, plus the inorganics not readily soluble and combined in some form with the pulp.

For example: the "soda" loss from a washing system is normally expressed as pounds of Na_2SO_4 per air-dry ton of kraft pulp, or as pounds of Na_2CO_3 per air-dry ton of soda or semichemical pulps. By calculation, the pounds of black liquor solids lost per pound of moisture-free pulp is indicated. This is quickly converted to pounds of black liquor solids per air-dry ton. Therefore, a factor expressing the ratio between pounds of Na_2SO_4 per pound of black liquor solids must be determined and used to render the "soda" loss in the liquor with the pulp leaving the final stage. To the figure of the "soda" loss in the liquor must be added the figure for the so-called "fixed soda," or that which is not readily soluble.

It is not the authors' intention at this time to define this "fixed soda" term, but the presentation of this displacement ratio concept should hasten the day when sufficient research will have been completed and published, to define this term to the satisfaction of the industry.

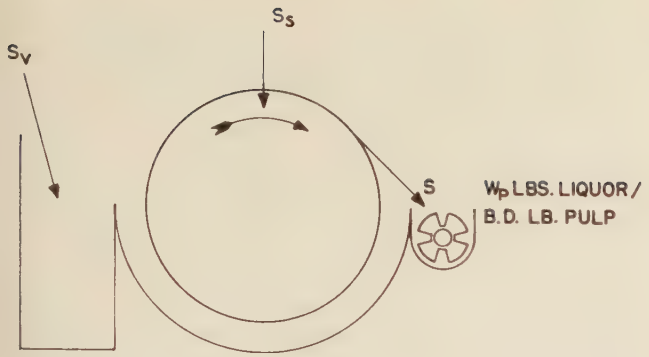

Fig. 1

reduction in soluble solids to the maximum reduction theoretically possible. From another approach, the maximum reduction in soluble solids occurs when all the vat liquor in the sheet has been replaced by shower liquor and the shower efficiency may be expressed by W_s/W_p, where W_s equals the shower liquor remaining in the washed sheet. The following shows that these expressions of efficiency are equal.

Let

W_p = total weight of liquor with the pulp leaving the washer at solids $S\%$
W_{fn} = weight of vat liquor with the pulp leaving the washer at solids $S_v\%$
W_s = weight of shower liquor with the pulp leaving the washer at $S_s\%$

$$\text{Liquor balance:} \quad W_p = W_{fn} + W_s$$

$$\text{Solids balance:} \quad (W_p)S = (W_{fn})(S_v) + (W_s)(S_s)$$

$$\text{Substituting:} \quad (W_p)S = (W_p - W_s)(S_v) + W_sS_s$$

$$W_s(S_v - S_s) = W_p(S_v - S)$$

$$\frac{W_s}{W_p} = \frac{S_v - S}{S_v - S_s}$$

It is possible to determine values for W_p directly from sheet consistencies, but W_s, the weight of shower liquor in the sheet, cannot be directly measured. As the three terms S, S_v, and S_s can be determined by solids analyses of the several liquors, this expression offers a means of measuring shower efficiency.

This same ratio W_s/W_p can be derived theoretically in terms of W_p, the dilution factor D, and the number of applications, n, of shower liquor on a single stage. Assume the washing action of the showers is a series of perfect dilutions and thickenings with the shower liquor being applied in n equal portions. Assume the consistency of the sheet returns to its original consistency after each application of shower liquor. Thus, the sheet approaches the first shower header with W_p lb. of liquor per lb. moisture-free pulp. As W_{ts} is the total shower liquor, W_{ts}/n lb. of shower liquor per lb. moisture-free pulp are applied. Perfect mixing of the applied shower liquor and sheet liquor then occurs, and the sheet is again thickened to W_p. Let W_f equal the original weight of vat liquor in the pulp sheet. Before the first shower, all the sheet liquor is vat liquor and W_f equals W_p. After the first shower liquor is applied, the proportion of W_f remaining in the sheet equals

$$\left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right)$$

and the weight of W_f remaining in the sheet W_{f1}, is:

$$W_{f1} = \left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right) \cdot W_f$$

After the second shower the proportion of W_{f1} in the sheet is

$$\left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right)$$

and the weight of W_f remaining in the sheet, W_{f2} is:

$$W_{f2} = \left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right) \cdot W_{f1}$$

after n showers the proportion of W_{fn-1} remaining in the sheet is

$$\left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right)$$

and

$$W_{fn} = \left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right) \cdot W_{fn-1}$$

By substitution

$$W_{fn} = \left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right)^n \cdot W_f = \left(\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right)^n \cdot W_p$$

Since the total weight of liquor equals the sum of the remaining vat liquor plus the remaining shower liquor:

$$W_p = W_{fn} + W_s$$

and

$$W_s = W_p - W_{fn} = W_p - \left[\frac{W_p}{W_p + \frac{W_{ts}}{n}}\right]^n \cdot W_p$$

Since

$$W_{ts} = W_p + D$$

then

$$\frac{W_s}{W_p} = 1 - \left[\frac{nW_p}{(n+1)W_p + D}\right]^n$$

This equation leads to a theoretical correlation between the displacement ratio W_s/W_p, or its equal $(S_v - S)/(S_v - S_s)$, and the dilution factor. Figure 2 is a plot

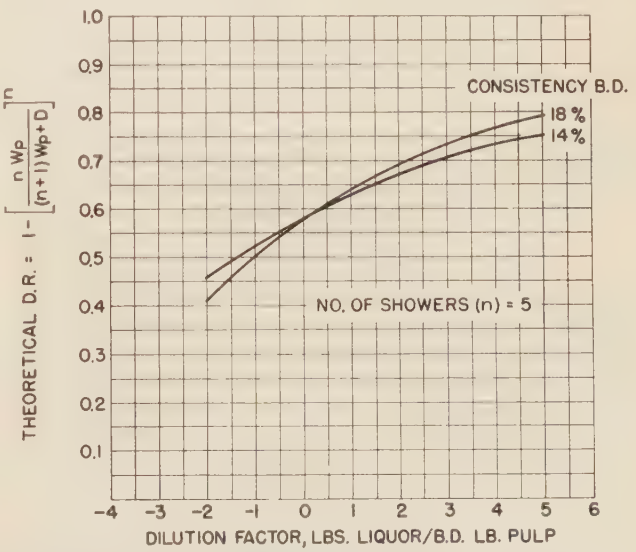

Fig. 2. Theoretical displacement ratio curve: effect of consistency

of this equation at constant n (fixed number of showers) with W_p expressed as consistency, as a parameter. Figure 3 is the same equation with W_p constant and n as the parameter.

USE OF THE DISPLACEMENT RATIO

Practical application of the "displacement ratio" concept is shown on Figs. 4, 5, and 6. For these curves values of S, S_v, and S_s were obtained over a wide range of dilution factors. These three empirical curves have the same general shape as the theoretical curve, indicating that the washing action of the showers is a function of the same form as the equation which was derived on the assumption that the operation is a series of perfect mixings. The locations of the points calculated from the empirical data do not coincide with the theoretical curve because the washing action of the showers is not a series of perfect dilutions and extractions back to the original consistency. Some of the vat liquor is displaced from the bottom of the sheet without being diluted with shower liquor and some liquor passes through the sheet more rapidly than it can diffuse with the vat liquor.

By definition the theoretical displacement ratio is *not* a function of all the independent and dependent variables of a washing system, but this concept offers a means of predicting the nature and magnitude of the effect on the washing efficiency of the sheet consistency, the number of shower headers, and the dilution factor. In practice, the term $(S_v - S)/(S_v - S_s)$ is a measure of the effect on washing of *all* the operating variables, independent and dependent, including such variables as wash liquor distribution, sheet distribution, shower temperature, and variables dependent on pulp characteristics. Some examples of the latter variables are: the specific loading which controls the sheet thickness and drum speed; the drainage rate which determines the vat consistency, cylinder submergence, and is a controlling factor in the tonnage rate; and foam formation which is dependent on the liquor and the amount of air entrainment on the stages. Furthermore, because of the manner in which the liquor samples must be obtained it may be assumed that the samples represent equilibrium conditions which may not exist in the vat and sheet. Therefore, the displacement ratio as

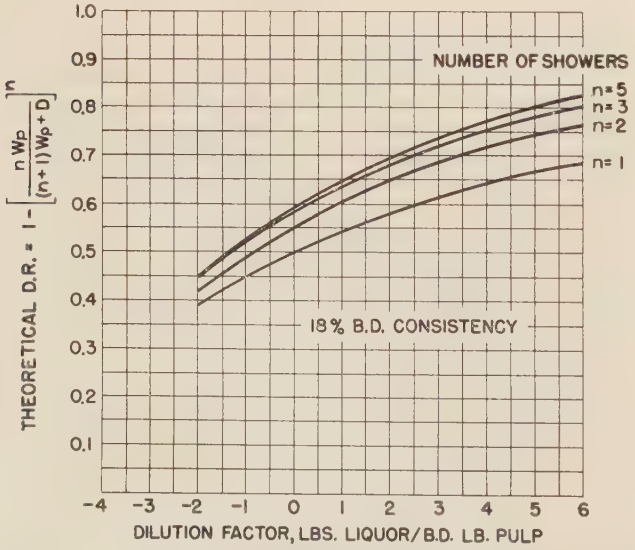

Fig. 3. Theoretical displacement ratio curve: effect of number of showers

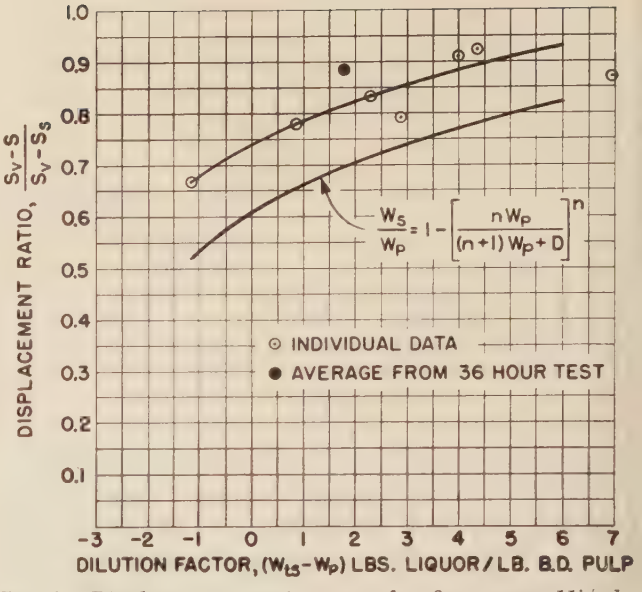

Fig. 4. Displacement ratio curve for first stage 11½ by 16-ft. brown stock washer

measured on the stage not only reflects the amount of displacement by the showers, but also encompasses the degree of mixing in the repulper and vats.

In light of the above considerations the differences in the location of the displacement ratio–dilution factor curves in Figs. 4, 5, and 6 can be examined.

The first-stage empirical data indicated a displacement ratio curve better than the theoretical indicating that the washing action is not entirely a diffusion process, but one of displacement also. The fact that this curve is much better than that of either the second or third stage is attributed to the presence of tiny air bubbles in the stock entering subsequent stages and more vigorous mixing of the primary dilution liquor with the blow liquor.

The faster drum speeds and the higher vat consistencies for the second and third stages are indicative of a drop in the drainage rate from that in the first stage. As the pulp is not subject to any mechanical action of a refining nature in passing from stage to stage, this decrease in drainage rate is attributed to the entrainment of air in the sheet on the first cylinder. (As pulp for the first stage comes directly from the blow tank, there is no such opportunity for air entrainment prior to that stage.) It is well established that minute bubbles of air take on the properties of solids during filtration. They will not pass through the sheet and will fill the voids between the fibers preventing free drainage of the liquor. These bubbles of foam lower the washing efficiency of the showers by decreasing the diffusion rate during mixing and they also channel the wash liquor through the sheet so that the shower liquid does not come in contact with all the fibers.

The high vat consistencies, which already have been attributed indirectly to the entrained air, are not only detrimental to the over-all efficiency of the system, but also adversely affect the washing efficiency of the shower. The blow tank dilution and agitation plus the action of the pump accomplish mixing that can hardly be duplicated in the intermediate repulpers. The mixing between stages is hindered by these higher operating consistencies, thus incomplete mixing in the intermediate repulpers will result in higher soluble solids

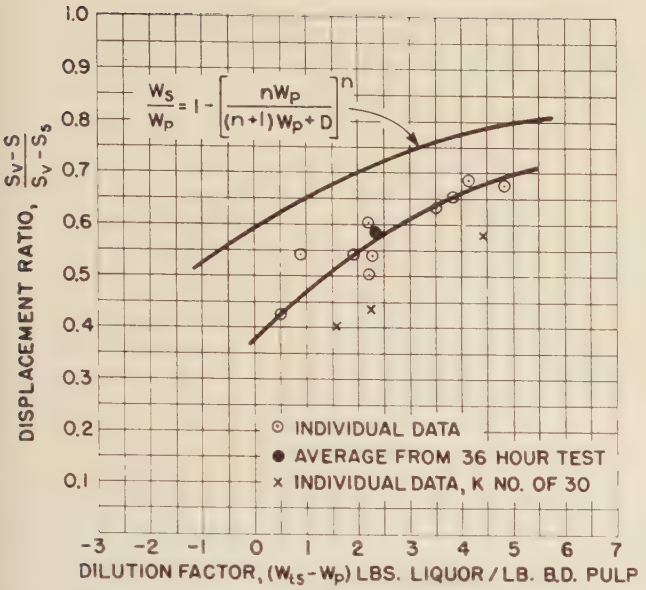
DISPLACEMENT RATIO, $\frac{S_v - S}{S_v - S_s}$
$\frac{W_s}{W_p} = 1 - \left[\frac{nW_p}{(n+1)W_p + D}\right]^n$
⊙ INDIVIDUAL DATA
● AVERAGE FROM 36 HOUR TEST
× INDIVIDUAL DATA, K NO. OF 30
DILUTION FACTOR, $(W_{ts} - W_p)$ LBS. LIQUOR / LB. B.D. PULP

Fig. 5. Displacement ratio curve for second stage brown stock washer

content in the sheet passing to the following stage. High vat consistencies are also a factor contributing to poor sheet formation and low sheet consistencies. The above reasoning being true, the over-all washing efficiency of a system may be increased by manipulation of the dependent variables to eliminate air in the sheet leaving the cylinders. (The better washing efficiencies obtained on some pulps, such as semichemical hardwoods, are attributed to their less-pronounced tendency to foam.)

Due to the shape of the displacement ratio-dilution factor curve, overwashing will not compensate for underwashing, and it is indicated that further improvement of the washing efficiency of any individual stage may be accomplished by:

I. Maintaining a constant ratio between the amount of wash liquor and pulp to be washed and a constant sheet consistency, i.e., an optimum dilution factor at all times which requires:

A. Constant tonnage rate; eliminating small swings in tonnage rate as well as intermittent shutdowns. (The wash room should never become the cushion between the digesters and screen room.)

B. Controlled amounts of wash liquid and equal wash liquor distribution across the pulp sheet.

C. Balanced liquor tanks and flows.

II. Obtaining the maximum amount of equilibrium or mixing between the liquor in the sheet from the previous stage and the dilution liquor added at the intermediate repulper which requires:

A. Good agitation with complete disintegration of the sheet entering the repulper.

B. The lowest possible vat consistency.

1. Consistent with a drum speed which does not overload the foam system.

2. By elimination of air in the entering sheet, thereby obtaining the maximum drainage rate.

3. By avoiding entrained air in the dilution liquor by maintaining proper tank levels.

4. By maintaining 50% ± submergence of the filter cylinder.

III. Good sheet formation which is a function of the vat consistency and agitation. Lumpy formation gives low displacement ratio.

IV. Preventing the build-up of soap in the system by assuring its constant removal.

The displacement ratio may be used in the familiar stepwise calculations for a material balance over an entire washing system. The calculations may be started from either the blow tank or the final stage. Thus, starting with the blow tank the first equation would be:

$$S_e = \frac{W_b S_b - W_p S_m}{W_b + D}$$

where

S_e = solids to the evaporator
S_b = per cent solids in the blow
S_m = per cent solids in the liquor with the pulp from the final stage
W_b = pounds liquor per pound pulp in the blow after flashing
W_p = pounds liquor per pound pulp from the final stage
D = dilution factor, pounds *liquor* per pound moisture-free pulp
$= W_{ts} - W_p$

S_m must be assumed and the calculations repeated until the calculated S_m equals the assumed S_m. In such a process the relationship:

$$D.R. = \text{displacement ratio} = (S_v - S)/(S_v - S_s)$$

simplifies the calculations over the usual assumption that each stage does an equal amount of washing. In addition, the use of the empirical relationship of displacement ratio to dilution factor offers a decided improvement in accuracy of the calculations since the necessity of assuming a soluble solids removal for each stage is eliminated.

The use of the displacement ratio concept in a stepwise material balance and as an indication of solids removed in individual washing stages has been pointed out. Further work was done when it appeared that formulas could be derived which would eliminate the stepwise calculation with its trial and error method.

In design calculations for countercurrent washers, vat and sheet consistencies are often assumed constant for various stages. With such the case the stepwise calculations can be simplified by combining these conditions into a group of factors, one for each stage, again using displacement ratios such that:

$$R_1 = \frac{S_1}{S_b},\ R_2 = \frac{S_2}{S_1},\ R_m = \frac{S_m}{S_{m-1}},\ \text{and}\ (R_1 \times R_2 \times \ldots R_m) = \frac{S_m}{S_b}$$

where

S_1 = per cent solids in liquor from stock leaving stage I
S_2 = per cent solids in liquor from stock leaving stage II
S_m = per cent solids in liquor with the pulp leaving the final washer

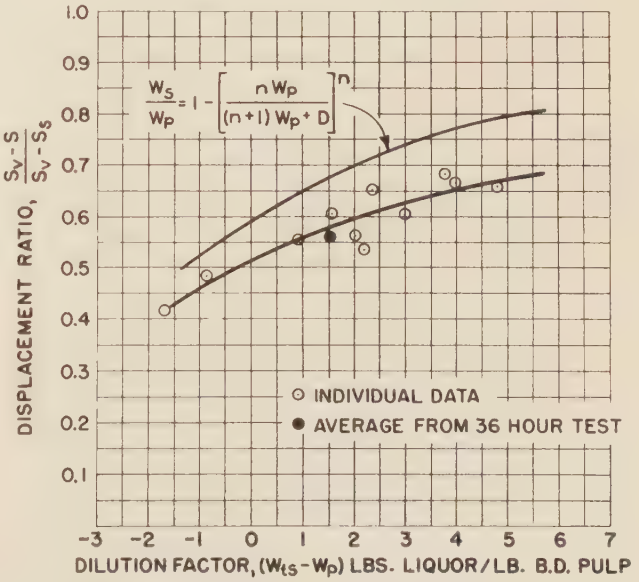
DISPLACEMENT RATIO, $\frac{S_v - S}{S_v - S_s}$
$\frac{W_s}{W_p} = 1 - \left[\frac{nW_p}{(n+1)W_p + D}\right]^n$
⊙ INDIVIDUAL DATA
● AVERAGE FROM 36 HOUR TEST
DILUTION FACTOR, $(W_{ts} - W_p)$ LBS. LIQUOR / LB. B.D. PULP

Fig. 6. Displacement ratio curve for third stage 11½ by 16-ft. brown stock washer

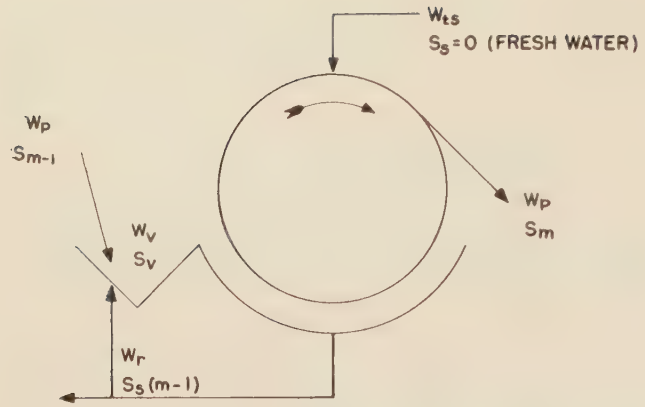

Fig. 7

It is assumed that all vat and sheet consistencies are the same in derivation of the R factors but exact values from field data may be substituted when known. Perfect mixing in the vat is assumed, but it has been shown that the empirical data will correct for this "impossible condition." The foundation of this concept is the fact that there is a relationship between the displacement ratio and the dilution factor.

Consider a system with m stages:

S_b = per cent solids in undiluted blow tank liquor
S = per cent solids in sheet leaving stage (any given stage)
S_a = per cent solids in sheet from any intermediate stage a
$S_a = R_a S_{a-1}$
S_s = per cent solids in shower liquor (any given stage)
S_v = per cent solids in vat liquor (any given stage)
R_s = liquor in sheet from washer/liquor in shower $= W_p/W_{ts}$
R_v = liquor in sheet from washer/liquor in vat $= W_p/W_v$
R_g = shower liquor in sheet from washer/total shower liquor
$R_g = R_s(S_v - S)/(S_v - S_s) = W_s/W_{ts} = R_s\,(D.R.)$
R_b = undiluted blow tank liquor/liquor in sheet from washer $= W_b/W_p$
R_e = liquor in sheet from washer/liquor to evaporator $= W_p/W_e$

$$\Pi\, R_{(1\to m)} = R_1 \times R_2 \times \ldots R_m \ddagger$$

$$W_{ts}\, S_{s(m-1)} + W_p S_m = W_{ts}\, S_s + W_p\, S_{m-1}$$

$$S_{s(m-1)} = \frac{W_p}{W_{ts}}\,(S_{m-1} - (S_m) = R_s(S_{m-1} - S_m)$$

$$S_v = \frac{W_p S_{(m-1)} + W_r S_{s(m-1)}}{W_v} = \frac{W_p}{W_v}\,(S_{m-1}) + \frac{W_v - W_p}{W_v}(S_{s(m-1)})$$

$$= R_v S_{m-1} + (1 - R_v)\,[R_s(S_{m-1} - S_m)]$$

$$R_{gm} = \left(\frac{S_v - S_m}{S_v - S_s}\right) \cdot R_s = \left(\frac{S_v - S_m}{S_v - 0}\right) \cdot R_s$$

$$S_m = \left(1 - \frac{R_{gm}}{R_s}\right) \cdot S_v$$

$$= \left(1 - \frac{R_{gm}}{R_s}\right)(R_v S_{m-1} + (1 - R_v)[R_s(S_{m-1} - S_m)])$$

$$= \frac{\left(1 - \frac{R_{gm}}{R_s}\right)[R_v + (1 - R_v)\,R_s]}{1 + \left(1 - \frac{R_{gm}}{R_s}\right)(1 - R_v)\,R_s} \cdot S_{m-1}$$

$$S_m = R_m \cdot S_{m-1}$$

$$R_m = \frac{\left(1 - \frac{R_{gm}}{R_s}\right)[R_v + (1 - R_v)\,R_s]}{1 + R_s\left(1 - \frac{R_{gm}}{R_s}\right)(1 - R_v)}$$

‡ This expression reads the product of R from R_1 to R_m.

Note that in this equation $R_{gm}/R_s = D.R._m$, where m designates the final stage.

Also:

$$R_a = \frac{\left(1 - \frac{R_{ga}}{R_s}\right)[R_v + (1 - R_v)\,R_s]}{1 + R_s\left(1 - \frac{R_{ga}}{R_s}\right)(1 - R_v)\,(\Pi R_{(a+1\to m)}) - R_{ga}\,(1 - \Pi R_{(a+1\to m)})}$$

$$R_1 = \frac{\left(1 - \frac{R_{gI}}{R_s}\right)[R_b R_v + (1 - R_b R_v)\,R_e R_b]}{1 + Re\left(1 - \frac{R_{gI}}{R_s}\right)(1 - R_b R_v)\,(\Pi R_{(2\to m)}) - R_{gI}\,(1 - \Pi R_{(2\to m)})}$$

$$S_m = (R_1 \times R_2 \times \ldots R_m) S_b$$
$$= (\Pi R_{(1\to m)}) S_b$$

Although the R factors appear complicated, they are very convenient to use since many of the terms are simple ratios which are repeated and need only be calculated once. When the relationship between S_b and S_m is desired at fixed conditions of dilution factor and consistencies, a whole series of calculations can be made quite rapidly without going through any stepwise balances, and no trial and error is involved. Likewise, a series of calculations at various dilution factors can be made by simply changing the terms in the R factors containing dilution and using the relationship of displacement ratio to dilution factor. The use of these formulas depends upon a thorough knowledge of the influence of the independent variables upon the washing efficiency and indiscriminate substitution of values, for these variables may lead to erroneous results. As an example: neither the displacement ratio term nor the solids reduction ratio term take into consideration specific loading (tons air-dry per 24 hr. production per sq. ft. of wire area on one cylinder) which dictates the lowest possible vat consistency, which in turn dictates the degree of equilibrium reached in the repulpers.

A washer calculation is given below to illustrate the use of the R factors together with displacement ratios to calculate a three-stage system.

Basis:
Blow tank solids = 20%
Blow consistency = 12.0% moisture-free
Dilution factor = 2.0 lb. liquid per lb. moisture-free pulp
Vat consistencies = 1.0% moisture-free
Sheet consistencies = 18% moisture-free

Displacement ratios:

Taken from curves in Figs. 4. 5, and 6

Brown stock washers:
First stage = 0.81
Second stage = 0.55
Third stage = 0.60

R factors calculated using the equations given above:
$R_3 = 0.224$
$R_2 = 0.413$
$R_1 = 0.307$ (see sample calculation)

$S_m = (R_1)\,(R_2)\,(R_3) S_b = (0.0283)\,(20) = 0.57\%$ solids in the liquor leaving with the washed pulp

Solids to evaporator, $\% = \dfrac{W_b S_b - W_p S_m}{W_b + D} = 15.4$

Thus, with blow solids of 20% at 12% moisture-free blow consistency the pulp would be washed to 0.57% solids in the sheet liquor.

The R factors can be used to determine the theoretical effect of consistencies by changing the proper terms in the equations. If the vat consistency was

changed to 2% and the sheet consistency to 15%, the solids in the washed sheet in the above calculation would increase to 0.82%.

Sample calculation no. 1 follows:

First Stage

Formula:

$$R_1 = \frac{\left(1 - \frac{R_{g1}}{R_s}\right)[R_bR_v + (1 - R_bR_v)R_eR_b]}{1 + R_e\left(1 - \frac{R_{g1}}{R_s}\right)(1 - R_bR_v)(R_2R_3) - R_{g1}(1 - R_2R_3)}$$

(Note that R_2 and R_3 must be found first.)

$$D = 2.0$$

$$\frac{R_{g1}}{R_s} = (D.R.)_1 = 0.81$$

$$R_b = \frac{W_b}{W_p'}\frac{W_b}{W_p} = \frac{(1 - 0.12)/0.12}{(1 - 0.18)/0.18} = \frac{7.33}{4.56} = 1.61 = R_b$$

$$R_v = \frac{W_p}{W_v'}\frac{W_p}{W_v} = \frac{(1 - 0.18)/0.18}{(1 - 0.01)/0.01} = \frac{4.56}{99.0} = 0.046 = R_v$$

$$R_s = \frac{W_p}{W_{ts}'}\frac{W_p}{W_{ts}} = \frac{(1 - 0.18)/0.18}{W_p + D} = \frac{4.56}{6.56} = 0.695 = R_s$$

$$R_e = \frac{W_p}{W_e'}\frac{W_p}{W_e} = \frac{(1 - 0.18)/0.18}{W_b + D} = \frac{4.56}{9.33} = 0.489 = R_e$$

$$R_{g1} = R_s(D.R.)_1 = 0.695\ (0.81) = 0.563$$

From prior calculations:

$$R_3 = 0.224$$

$$R_2 = 0.414$$

By substitution:

$$R_1 = \frac{(1 - 0.81)\,[(1.61)\,(0.046) + (1 - 1.61 \times 0.046)\,(0.489 \times 1.61)]}{1 + 0.489\,(1 - 0.81)\,(1 - 1.61 \times 0.046)\,(0.224 \times 0.414) - 0.563\,(1 - 0.224 \times 0.414)}$$

$$R_1 = 0.307$$

Sample calculation no. 2 follows. To illustrate the single-stage formula, a set of conditions has been assumed. A calculation for the liquor solids leaving the system with the filtrate is shown:

$$R_0 = \frac{\left(1 - \frac{R_g}{R_s}\right)[R_bR_v + (1 - R_bR_v)R_eR_b]}{1 + R_e\left(1 - \frac{R_g}{R_s}\right)(1 - R_bR_v)}$$

$$S_m = R_0S_b$$

$$S_e = \frac{W_bS_b - W_pS_m}{W_b + D}$$

Semichemical data:

Liquor solids as dumped	= 9.2%
Chip consistency after draining	= 32.5% moisture-free
Dilution factor	= 5.0
Vat consistency	= 0.9% moisture-free
Sheet consistency	= 17.0% moisture-free
Displacement ratio	= 0.90

$$\frac{R_g}{R_s} = D.R. = 0.90$$

$$R_b = \frac{W_b}{W_p} = \frac{(1 - 0.325)/0.325}{(1 - 0.170)/0.170} = \frac{2.08}{4.88} = 0.426$$

$$R_v = \frac{W_p}{W_v} = \frac{(1 - 0.170)/0.170}{(1 - 0.009)/0.009} = \frac{4.88}{110.1} = 0.0443$$

$$R_s = \frac{W_p}{W_{ts}} = \frac{(1 - 0.170)/0.170}{W_p + D} = \frac{4.88}{9.88} = 0.494$$

$$R_e = \frac{W_p}{W_e} = \frac{(1 - 0.170)/0.170}{W_b + D} = \frac{4.88}{7.08} = 0.689$$

By substitution:

$$R_0 = \frac{(1 - 0.90)\,[(0.426 \times 0.0443) + (1 - 0.426 \times 0.0443)\,0.689 \times 0.426]}{1 + 0.689\,(1 - 0.90)\,(1 - 0.426 \times 0.0443)}$$

$$R_0 = 0.0267$$

$$S_m = 0.0267 \times 9.2\% = 0.246\%$$

$$S_e = \frac{2.08 \times 9.2 - 4.88 \times 0.246}{2.08 + 5} = 2.53\%$$

Forecasting the economic feasibility of an additional stage of washing becomes apparent after examination of the equations. The formulas are so derived that the *Ra* for any intermediate stage of a multistage system may also be calculated. The improvement of additional stage may be readily determined by the formula

$$R_1 \times R_2 \times R_3 \times \ldots R_m = \frac{S_m}{S_b}$$

However, this equation must be used with reservation until empirical data are available to establish the displacement ratios of the intermediate stages of systems with more than three stages.

CONCLUSION

In conclusion it is believed that the concepts pointed here will promote a better understanding of the washing accomplished in a countercurrent system, and the ratio $(S_v - S)/(S_v - S_s)$ offers a practical means of evaluating washing variables. It is hoped that others will make use of these methods on various types of pulp and under the many different conditions existing in the industry today.

One complete series of tests indicates that the empirical displacement ratio-dilution factor relationship can be expressed as a constant (K) multiplied by the theoretical equivalent of the displacement ratio shown in Fig. 2. This empirical expression would then take the following form:

$$\frac{W_s}{W_p} = \frac{S_v - S}{S_v - S_s} = K\left\{1 - \left[\frac{nW_p}{(n + 1)W_p + D}\right]^n\right\}$$

where K is an empirical displacement constant and a function of the independent variables of the system.

It is hoped that the constant K will be determined on a wide range of pulps, correlated, and made available industry wide.

With the empirical K values established, the solids reduction ratios or R factors may be used to eliminate the tedious stepwise calculations for any specific washing system; however, further use of this theoretically correct formula will depend upon the availability of the empirical data.

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Influence of Fiberizing Variables in Producing Semichemical Pulp

FRIEDRICH A. AFLENZER

Aspen wood chips pulped by the neutral sulphite semichemical process were fiberized and refined in a 36-in. double-disk attrition mill at the Forest Products Laboratory. The main fiberizing variables—size and moisture content of the chips, water temperature, number of passes, plate clearance, rate of feed, and consistency of the pulp—were examined. It was found that, for best results, the semichemical chips should be predisintegrated to a uniform small size before fiberizing. For a given strength the fiberizing should be carried out in one pass for minimum energy consumption or multipasses for highest pulp freeness. Further, the chips should have a moisture content of at least 60%, and hot water should be used during fiberizing. At the same production rate bursting strength and tensile strength were higher when the consistency of the pulp between the plates was higher than 10%, but tearing resistance and energy consumption were optimum at about 8 to 10% consistency.

Up to 30 years ago it was common to disintegrate and refine pulp only in beaters, jordans, and various other types of refiners. With the development of the high-yield semichemical processes a new problem entered, namely, the conversion of treated chips in one or two fiberizing and refining steps into a stock suitable for producing board or paper. The importance of the fiberizing step of the semichemical process has become more and more recognized, especially in making semichemical pulps for high-grade papers. Double and single-disk refiners have found increasing acceptance in the pulp and paper industry for this fiberizing stage.

In fiberizing chips to an acceptable pulp, new influences enter that make the stock preparation system more complex than when slush chemical or groundwood pulps are processed. Very little is known about the importance and correlation of the different variables in fiberizing of semichemical pulp. The old beating and refining theories are applicable only to a certain degree because of the different construction and operation characteristics of disk refiners as compared to older types of refiners.

The complexity of the fiberizing process requires that the study of the variables and the estimation of optimum conditions be based upon a great number of experiments. Full judgment can only be made when these experiments are carried out with a commercial-sized machine (*4*, *5*). Refining experiments on small-sized laboratory mills give some good ideas about the various influences in fiberizing semichemical pulp, but the operating conditions of a commercial-sized mill are different and, therefore, any comparison of results obtained with a small mill with those from a commercial sized mill has to be considered very carefully.

Primary studies of an informative character on the different effects of fiberizing variables were previously carried out on an 8-in. single-disk laboratory mill at the Forest Products Laboratory (*1*). The work presented in this report is based upon experiments carried out with a 36-in. double-disk attrition mill (Fig. 1), and in the following section the degree of similarity in results obtained on the small mill and on the commercial-sized mill will be pointed out.

In commercial operation it is difficult, of course, to isolate one variable and to keep all the other variables constant. The fact that each variable is only controllable to a certain degree has an effect upon the efficiency of the operation and upon the quality of the product. The variables examined in this investigation were: (1) the condition of the chips (size and moisture content), (2) the temperature of the water introduced into the action zone, (3) the number of passes, (4) the clearance between the plates of the mill, (5) the rate of feeding, and (6) the consistency of the pulp between the plates. Several other variables, such as speed of rotation, direction of rotation, and size and pattern of the fiberizing disks have a great influence on fiberizing but could not be examined.

FIBERIZING EXPERIMENTS

Material

Aspen (*Populus tremuloides*) chips of standard $^5/_8$-in. size were pulped by the neutral semichemical process for the tests. These chips were pulped to a yield of 72.8%. The moisture content of the cooked and washed chips was between 75 and 80%. The treated chips made in one digestion were sufficient for the whole study.

Double-Disk Mill

A 36-in. double-disk mill (Bauer no. 185) equipped with two 125-hp. motors (1200 r.p.m.), a screw feeder with a variable speed arrangement, and a mechanical adjustment for plate clearance was used. Throughout all experiments plate no. B914 was used (Fig. 2). This bidirectional plate is recommended by the manufacturer for semichemical pulp for use in wallboard, book paper, and container board. Because the power load of the mill is very sensitive toward variation in water supply and setting of the plates (Fig. 3), it was necessary to install a flowrator to regulate exactly the amount of water introduced into the action zone. The water is necessary for cooling the plates and washing out the pulp from the mill casing. This water has

Friedrich A. Aflenzer, Collaborator, Forest Products Laboratory, maintained at Madison, Wis., in cooperation with the University of Wisconsin, Forest Service, U. S. Department of Agriculture.

Fig. 1. Commercial-sized double-disk attrition mill used in fiberizing experiments

no immediate influence on the fiberizing action and pulp quality.

On the small laboratory mill it is possible to check the clearance between the plates with a feeler gage before and after every run. This method, however, is not practical on a commercial-sized mill. Therefore, a "zero" setting was established that was adjusted after the mill was warmed up for 20 min. At a water supply of 2.1 g.p.m. (checked with the flowrator) the clearance between the plates was changed by turning the adjusting screw until a constant load of 56 kw. was indicated on the power load recorder. The dial on the adjusting screw was then set to zero. This zero setting can be adjusted very precisely and exactly and is independent of the expansion of the plates due to heat.

The power load was measured by a kilowatt-hour meter. For the calculation of the energy consumption per ton of moisture-free pulp, the values indicated on the kilowatt-hour meter were multiplied by an efficiency factor of 0.85.

The temperatures of the water introduced into the mill and of the pulp coming out were measured by a thermometer and a temperature recorder.

Testing Procedure

Average samples were taken from the chest below the mill. Test sheets were made according to TAPPI Standard T 205m. The fiber analysis was carried out with a Bauer-McNett fiber classifier using 20, 35, 65, and 150-mesh screens.

INFLUENCE OF CHIP SIZE AND MOISTURE CONTENT

In every refining or fiberizing process it is generally important that the material fed to the refiner or fiberizer be uniform in size and moisture content, especially when the process is continuous.

In previous experiments on a laboratory disk mill, at the same energy consumption, feeding small, uniform-sized chips (about $^1/_2$ in. long and $^1/_2$ in. thick) gave 20% higher tearing resistance and much higher bursting strength than feeding larger sized chips (*1*). Furthermore, it was found that the moisture content in the chips has a large effect on behavior in fiberizing and on pulp properties and should be not less than 60%. Pulp made from dry chips was low in strength, and the fiberizing process had a high energy requirement. Based on this experience several runs with the 36-in. mill were carried out using chips of different moisture content and chip size.

The energy consumption and the pulp properties resulting when normal-sized and small, predisintegrated chips were fiberized under the same conditions are given in Table I. The small chips were obtained by disintegrating the normal chips. Their predisintegration required 2.8 hp.-days per ton of energy.

When the small chips were used a pulp of appreciably higher bursting strength and tensile strength was obtained. The screw feeder is sensitive toward overloading, however, when small chips are fed, and a feeder of another type should be installed for this type of material.

The influence of the moisture content of the chips is shown in Table II. At high moisture content less energy is necessary and better strength is obtained. At low moisture content, however, the amount of fines, or short-fiber bundles, is higher. The amount of fibers passing through a 150-mesh screen was 18.8% with chips of 71.8% moisture content and 24.5% with chips of 14.4% moisture content. Pulps from chips low in moisture content showed poor fiber bonding, and the test sheets were low in density and had poor formation. Further, the energy consumption in fiberizing was about 17% less for the chips with high moisture content than for chips with low moisture content. This value is in accordance with results reported by Cosler (*3*).

INFLUENCE OF WATER TEMPERATURE

The influence of the temperature of the water introduced into the action zone was examined in the range of

Fig. 2. Fiberizing plate used in double-disk attrition mill

Table I. Influence of Chip Size on Fiberizing and Strength Properties of Semichemical Pulps

Chip size	Energy consumption, hp.-days per ton	Daily production, tons	Freeness (Canadian Standard), ml.	Bursting strength, pt./lb./rm.	Tearing resistance, g./lb./rm.	Breaking length, m.	Density, g./cc.
Normal[a]	25.0	4.7	530	0.57	1.16	5760	0.63
Small[b]	24.3[c]	4.95	500	0.71	1.15	6500	0.66

a 15 mm. in grain direction, 3 mm. thick, and 25 mm. wide.
b 10 mm. in grain direction, 2 mm. wide and thick.
c Made up of 2.8 hp.-days for disintegrating and 21.5 hp.-days per ton for fiberizing.

11 to 55°C. The chips were soaked for 15 min. to bring them to the operating temperature and then fiberized. The mill was warmed up to the desired temperature before the plate clearance was adjusted. The increase in temperature caused by fiber-fiber, fiber-plate, and plate-plate friction is expected to be the same when the fiberizing is carried out under the same conditions.

As shown in Fig. 4, significant increases in tearing resistance and breaking length were obtained when the water temperature was increased. The energy consumption decreased from 7 to 12% when the water temperature was raised from 11 to 55°C. It seems that the water temperature should be kept as high as possible; with the laboratory-sized mill it was found that the water temperature should be at least 50 to 60°C. (*1*). Actually, most semichemical pulp mills use hot water for fiberizing.

There seems to be some correlation between fiberizing and wood grinding, in which the same trends in variation of pulp properties and energy consumption with changes in temperature were found when the grinder stone was neither too sharp nor too smooth (*2*).

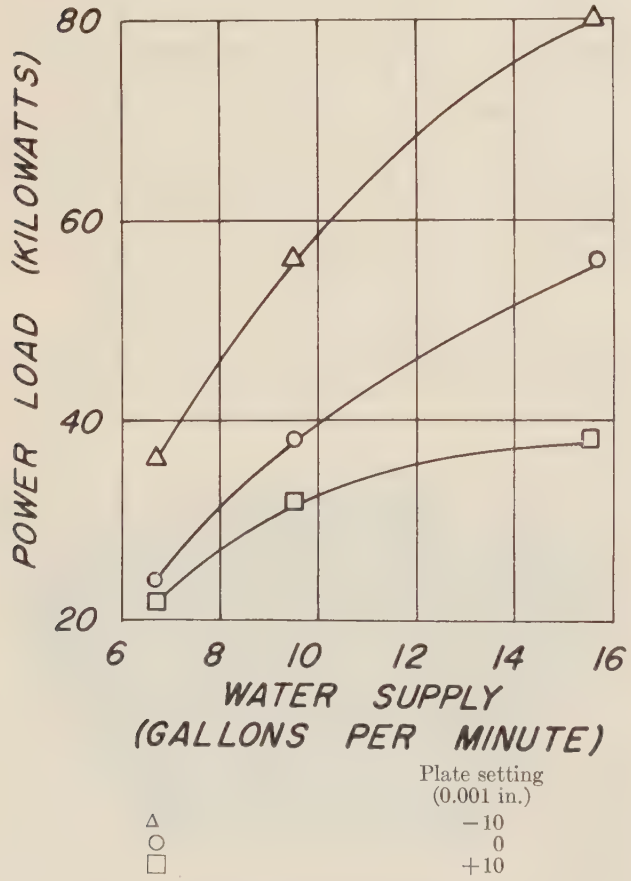


Fig. 3. Relation between water supply and power load at different plate settings

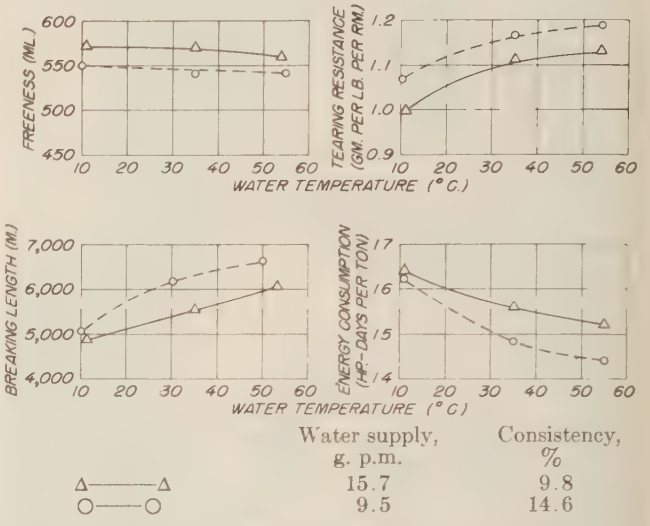


Fig. 4. Influence of water temperature on pulp freeness (Canadian Standard), breaking length, and tearing resistance, and energy consumed in fiberizing. Plate setting was zero

INFLUENCE OF CLEARANCE BETWEEN FIBERIZING PLATES

Starting from the "zero" setting, the clearance between the refining plates was changed in the range of −0.0020 to +0.0025 in. The chips were fed at a rate that placed a full energy load on the mill, except at a setting wider than +0.0020 in., where the feeding rate might have been higher. Three series of runs were carried out with different amounts of water. The results for freeness, bursting strength, energy consumption, and daily production (feeding rate) are shown in Fig. 5. As expected, increases in strength properties, as typified by bursting strength, as well as in energy consumption were obtained when the plates were closed. At the same setting but with less water supplied the strength properties developed were higher but more energy was consumed. The clearance between plates is a measurement that is only helpful for the operation of a particular mill. The energy consumed is a more reproducible measurement since sensitive and accurate instruments are used.

The relations between energy consumption and breaking length and daily production are shown in Fig. 6. At the same energy consumption a higher breaking length was obtained when less water was supplied. The daily production at the same energy consumption was about the same for different rates of water supply. This proves that the higher energy consumption when more water is used is due to the energy consumed for water circulation. When the supply rate was increased from 6.75 to 15.7 g.p.m., the energy load for pumping the water increased more than 100%. (The kilowatts recorded increased from 24 to 56 as shown in Fig. 3.)

Table II. Influence of Moisture Content on Fiberizing and Strength Properties of Semichemical Pulps

Chip moisture, %	*Energy consumption, hp.-days per ton*	*Daily production, tons*	*Freeness (Canadian Standard), ml.*	*Bursting strength, pt./lb./rm.*	*Tearing resistance, g./lb./rm.*	*Breaking length, m.*	*Density, g./cc.*
75.0	16.3	12.9	545	0.57	1.04	5100	0.58
40.9	17.5	13.5	570	0.46	0.93	4980	0.53
14.4	19.7	13.9	570	0.38	0.80	4200	0.47

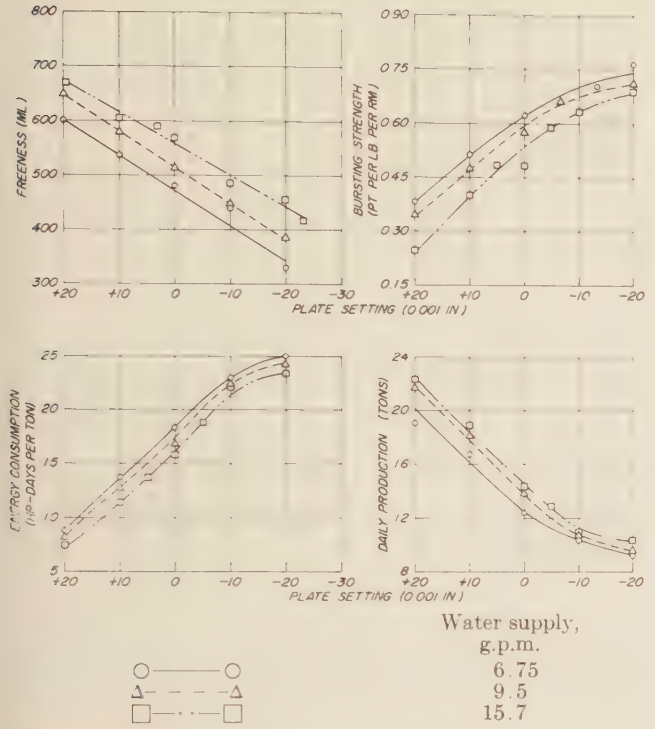


Fig. 5. Influence of plate setting (clearance between fiberizing plates) on pulp freeness (Canadian Standard) and bursting strength, energy consumed in fiberizing, and daily production

INFLUENCE OF NUMBER OF PASSES THROUGH MILL

Experiments were made to answer the question of whether the fiberizing should be done in one pass or in more passes. The base pulps for these experiments were made at plate openings of −0.0010, 0, and +0.0015 in. and a consistency in the range of 8.5 to 10%. The defibered pulps were then dewatered on a wet machine to a consistency of 28% and passed again through the mill at a consistency of 8.5 to 10%. The number of passes through the mill with intermediate dewatering varied from two to six times with the different base pulps. In feeding the dewatered pulp to the mill, the full load of the mill could never be reached even when the pulp was fed at the highest speed of the feeding screw.

The relationships between bursting strength, energy consumption, and freeness after the multipass treatment of the three base pulps are given in Fig. 7. Freeness is taken as the dependent variable, although it is generally recognized that this measurement of drainage has certain limitations. The freeness test, however, is used in most pulp and paper mills as a measurement of the drainage properties of a pulp and in connection with the fiber length it probably has significance.

The relationships in Fig. 7 show that more energy is consumed to obtain a given bursting strength when wide plate clearances and repeated passes are used. The same trend was found for breaking length. In every pass a portion of the total energy is consumed by water circulation and is lost as heat. This makes the multipass operation relatively inefficient. On this basis it appears that the fiberizing should be done with a plate setting requiring only one pass to give the desired strength. A disadvantage of the single-pass method however, is that the freeness is lower at a close setting than at a more open setting with a multipass operation for the same bursting strength.

The fiber length index showed the same trends as the freeness. Thus, for a given freeness the fiber length index is lower when a close setting and one pass are used than when a wider setting and multiple passes are used.

INFLUENCE OF FEEDING RATE OR DAILY PRODUCTION

The feeding rate, that is the amount of chips fed into the fiberizing zone per time unit, depends not only on the speed of the screw feeder but also on the water supply and, of course, on the plate clearance and chip condition. The relations of feeding rate, expressed in terms of daily production, to freeness, tearing resistance, bursting strength, and energy consumption are shown in Fig. 8. The influence of the rate of water supply is also shown in Fig. 8. Pulp freeness increased and bursting strength decreased with higher daily production, as expected. The fiber length index followed the same trend as the freeness. The tearing resistance had an optimum value with respect to daily production and was higher when more water was used. About the same bursting strength and breaking length were obtained with a low water supply and a high daily

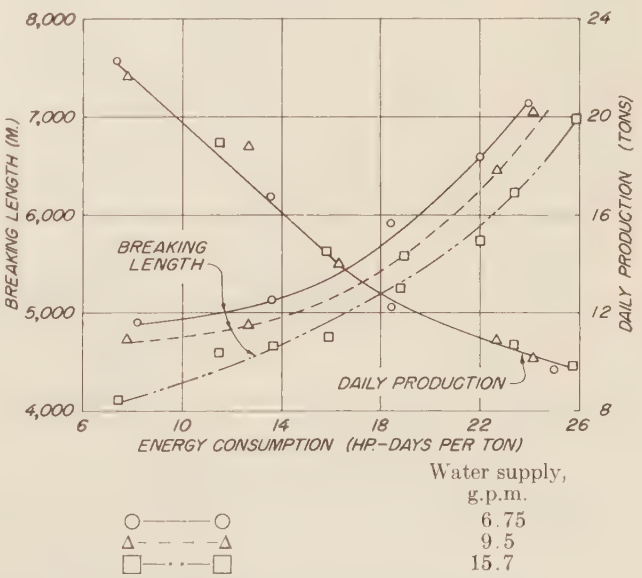


Fig. 6. Effect of energy consumed in fiberizing on breaking length and daily production

Table III. Influence of Plate Clearance on Fiberizing and Strength Properties of Semichemical Pulps

Plate clearance, in.	*Water supply, g.p.m.*	*Daily production, tons*	*Energy consumption, hp.-days/ton*	*Freeness (Canadian Standard), ml.*	*Tearing resistance, g./lb./rm.*	*Bursting strength, pt./lb./rm.*	*Breaking length, m.*	*Density, g./cc.*	*Consistency, %*
0	15.9	14.4	15.9	580	1.21	0.47	4720	0.603	9.8
0.035	None	18.5	11.7	570	1.10	0.54	5860	0.70	28
0.050	None	18.9	5.98	720	1.13	0.29	3240	0.47	28
0.060	None	19.6	5.3	755	1.22	0.14	2070	0.41	28

production as with a high water supply and a low daily production because in the latter case the fiber-fiber friction is less. These experiments show that it is particularly important to design the feeding system so as to provide an even feeding rate of pulp or chips to the mill.

INFLUENCE OF PULP CONSISTENCY

The effect of pulp consistency at different feeding rates was investigated. In these experiments the water supply was varied independently to cause changes in consistency at three different levels of daily production.

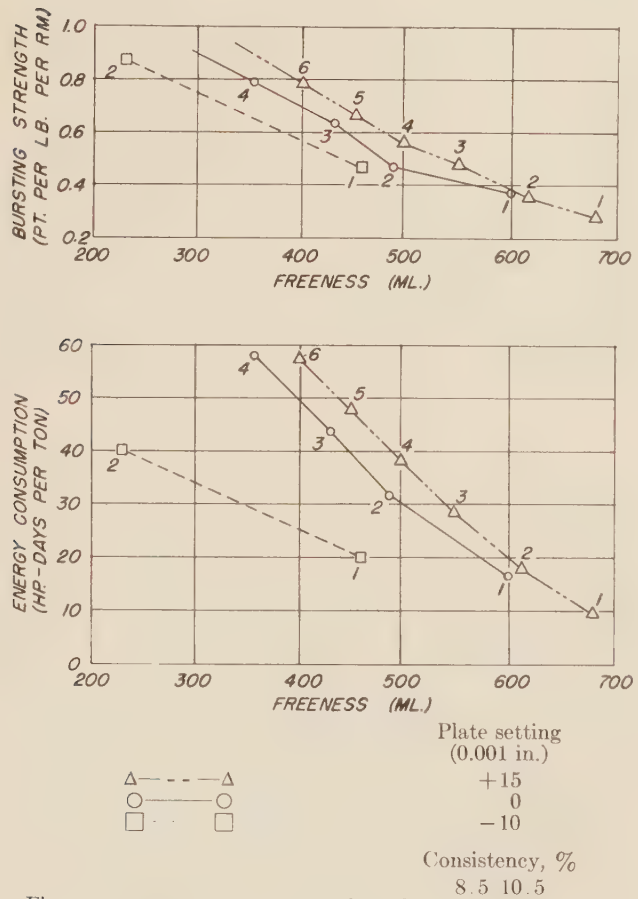
The breaking length (and the bursting strength) increased and the fiber length index and the freeness decreased with increase in consistency at a given level of daily production (Fig. 9). The tearing resistance showed little variation up to a certain consistency (about 8%). Beyond this point, however, the tearing resistance unavoidably decreased because of the effect of the decrease in average fiber length. At a given consistency the tearing resistance increases with increasing daily production.

The same breaking length was obtained at a consistency of 15% and a daily production of 12 tons as at a consistency of 6% and a daily production of 6 tons.

As shown in Fig. 10, the curves for energy consumption pass through a minimum with respect to consistency that depends on the daily production. The optimum energy consumption occurred between 8 and and 12% consistency. The energy consumption per breaking length of 1000 meters decreased by about 13 to 21.5% when the consistency was increased from 6 to 15%. In other words, for the same energy consumption, higher breaking length and bursting strength were developed and fewer screen rejects were obtained at higher consistencies than at lower consistencies.

Because of these favorable results, the experiments were extended beyond the normal commercial range by fiberizing semichemically treated chips containing 28% moisture without supplying additional water into the action zone. Water was used only on the outside of the fiberizing plates for cooling. Under these conditions the chips were fed at a high rate with a wide clearance (0.035 to 0.060 in.) between the plates.

At a clearance of 0.035 in. improved strength properties were obtained with a higher daily production rate and lower energy consumption than at zero setting and about 10% consistency (Table III). The temperature of the pulp in the chest after fiberizing was about 75°C. When the clearance between the plates was



Figures on curves represent number of passes.

Fig. 7. Influence of number of passes between plates on relation of pulp freeness (Canadian Standard) to bursting strength and energy consumed in fiberizing

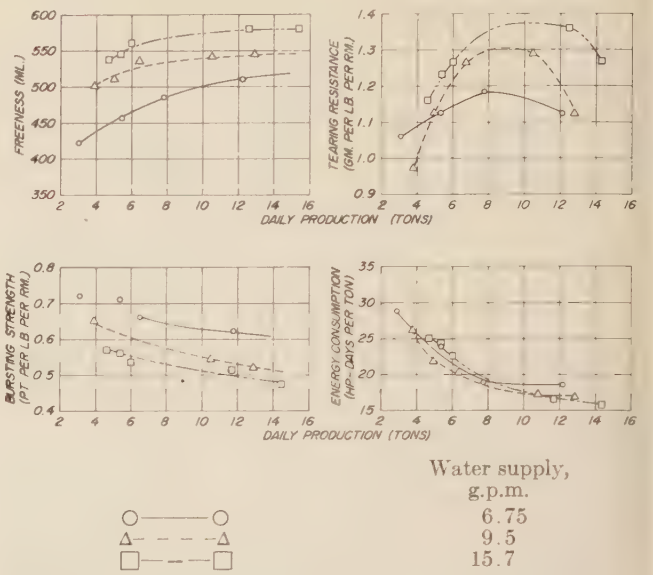


Fig. 8. Relation of daily production to pulp freeness (Canadian Standard), tearing resistance, and bursting strength, and energy consumed in fiberizing. Plate setting was zero

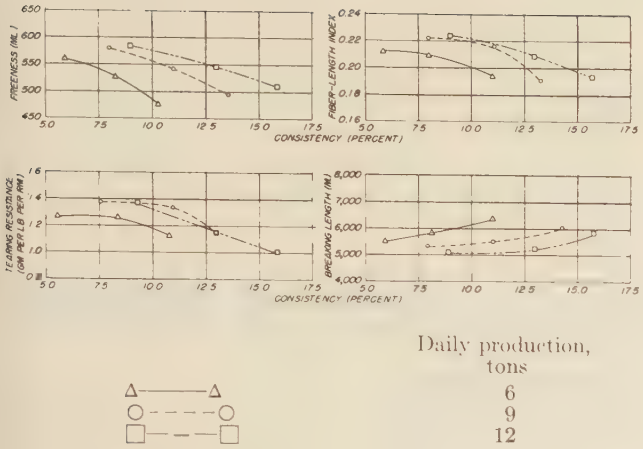


Fig. 9. Relation of consistency to pulp freeness (Canadian Standard), fiber-length index, tearing resistance, and breaking length. Plate setting was zero

less than 0.025 in., the temperature increased rapidly. When the clearance was 0.035 in., there was no difficulty in feeding the chips at a high rate. The fibers were very well separated, and no fiber bundles were present. The fibers coming out from the mill, however, were balled together in crumbles, which would have to be disintegrated before the pulp could be screened or run over the paper machine. This disintegration can be done very easily and quickly, however. The formation of balls evidenced a rolling action between the plates. For high-density fiberizing the chips need to be soft. In dry chips or chips of low moisture content the fibers are stiff and would be cut and degraded. Pulp made from dry fibers in previous experiments had poor strength properties (*1*). In the high-density fiberizing there was no harmful effect on the plates because of the wide clearance between them. Examination of the plates after fiberizing at high consistency (16 to 28%) revealed neither blocking of the grooves nor forming of fibrages. The decrease in fiber length was therefore not due to cutting between plate and fiber, but to the increased friction between the fibers and the rolling and twisting action between plates and fibers. It seems, however, that at a higher consistency the action between fibers is more important for strength development than the action between plates and fibers (Fig. 8). The rolling twisting, and fiber-fiber action are of advantage as long as fiber bundles are defibered and the fiber-fiber action is not too rough. Otherwise the inherent strength of the individual fiber is impaired, too many fines are formed, the tearing strength of the pulp is lowered, and too many fines are lost during papermaking.

CONCLUSIONS

The double-disk attrition mill as used with semichemical chips is chiefly a fiberizer, that is, a machine for fiberizing the chips into single fibers. For semichemically treated chips the best operation is a two-step system. In the first or breakdown step the chips should be disintegrated to a uniform small size. In the second step the fibers should be separated or isolated and the desired strength properties developed to the extent possible.

For economical energy consumption the second or fiberizing step should be done in one pass through the mill (if by so doing the desired strength property is developed). Hot chips should be fiberized and hot water (at least 50 to 60°C.) should be supplied to the mill.

The moisture content of the chips has a great influence on the strength properties of the pulp and energy consumption in fiberizing and should be kept as high as possible, especially in high-density fiberizing. Under the same fiberizing conditions the energy consumption is 17% less and fewer screen rejects are obtained with chips of high moisture content than with dry chips.

At the same feeding rate, or daily production, better strength properties are obtained if the water supply is reduced thereby raising the consistency. High-density fiberizing (consistencies higher than 10%) is to be preferred when high breaking length and bursting strength should be developed. The tearing resistance decreases when the consistency is higher than 10%. At the same daily production the energy consumption per breaking length of 1000 meters decreases at high consistency. In fiberizing at consistencies up to 30%, without additional water in the fiberizing zone, there are no difficulties if soft chips are fed. Under these conditions better strength properties at higher daily production and less energy consumption are obtained than at a consistency of 10%. The energy consumption is less because no energy is lost for circulation of water and formation of turbulences between the plates. Furthermore, the same strength properties can be developed with greater clearance between the fiberizing plates and, therefore, there is little danger of burning out the plates.

The conclusion is justified that water turbulences formed at a low pulp consistency between the fiberizing plates are not of much value for the fiberizing action because they consume a large quantity of energy. The fiber-fiber action and the plate-fiber action are important in the process of rolling and twisting. These actions increase in high-density refining.

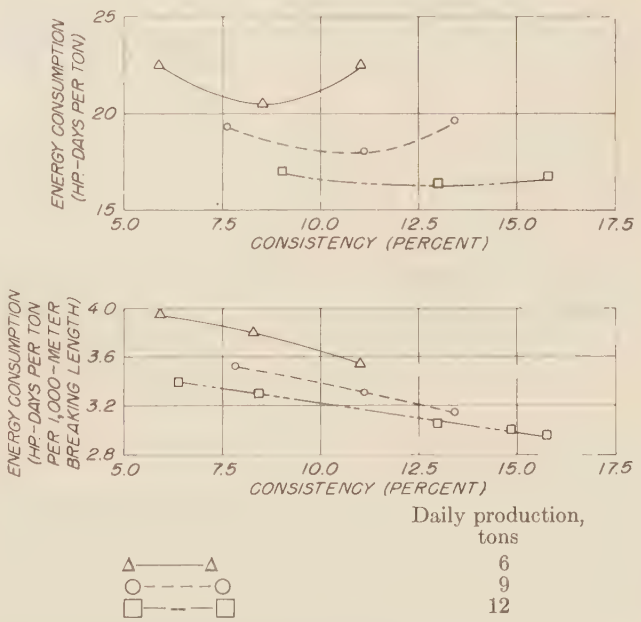


Fig. 10. Relation of consistency to energy consumed in fiberizing. Plate setting was zero

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Influence of Heavy Beating of Cotton Fibers on Molecule Length and Crystallinity

C. F. WIJNMAN

When purified cotton fibers are subjected to heavy beating in a Jokro mill, a large decrease of the cellulose D.P. can be observed, accompanied by a moderate reduction in the average size of the crystalline regions and a small reduction in the total crystalline portion. On the other hand, when dry cotton is ground to a fine powder most of the crystalline portion will be destroyed.

Judging from viscosity determinations, the degree of polymerization (D.P.) of the cellulose decreases when dry rayon, wood pulp, or cotton fibers are ground in a ball mill (*5, 10, 11, 12, 22*). This is accompanied by a decrease of the degree of crystallinity (D.C.) as was deduced from the change in the x-ray diagram (*5, 9, 10*) and from the increased accessibility (*16*). In extensively ball milled rayon the D.C. determined by means of an x-ray method, will decrease from 40 to about 9% and rise again to the original value after recrystallization in hot water (*9*). Ball milling of moistened cotton fibers likewise reduces the D.P. (*20*).

With regard to beating in Hollanders or Jokro mills of fiber suspensions in water, several authors have noticed a decrease of D.P. (*18, 22*), while others have not (*2, 17, 20*), although very heavy beating had been applied. In one instance only (*1*) in which softwood pulp had been used, the D.C. (deduced from the sorption ratio) was determined before and after beating; there was no change.

Hence the question whether wet beating will cause any decrease of D.P. and, if so, whether or not this will be accompanied by a decrease of D.C., cannot be answered satisfactorily. Using cotton fibers treated in a laboratory Jokro mill, this point was investigated further by determining the D.P. (viscosity), the D.C. (sorption ratio, x-ray method), and the relative crystal size. For comparison, the D.C. of cotton fibers ground in a ball mill in dry condition was also determined.

PROCEDURE

Material

Raw cotton was purified according to the procedure outlined by Corey and Gray (*4*). Five-gram samples, suspended in 170 ml. of water, were beaten in a laboratory Jokro mill (*19*) for 12 and 23 hr., respectively. After homogenization of the suspension the fibrous material was rapidly sucked off and dehydrated with absolute ethanol on a vacuum filter and vacuum-dried over P_2O_5.

In order to prepare the dry-milled sample, purified cotton was first ground in a laboratory hammer mill, and afterwards milled in a normal rotating ceramic ball mill for 25 hr.

Degree of Beating

The freeness was determined with a Schopper-Riegler apparatus, but the values are open to doubt because the fibers had been reduced in size to such an extent that part of them passed through the sieve in the apparatus. Therefore, the swelling was also determined according to Jayme and Rothamel (*14*). This was done in quadruplicate. Furthermore, photomicrographs of the beaten samples were taken.

Hygroscopicity

The sorption ratio was determined as described by Hermans (*6*), but a saturated NaCl solution was used for conditioning instead of dilute sulphuric acid (*23*). Then the relative humidity at 25°C. is 75% (*24*). After conditioning the water content of the samples was determined by drying at 110°C. in a stream of P_2O_5 dried nitrogen (see *6*, p. 200).

The Degree of Crystallinity

The D.C. was estimated by two methods.

Postulating a D.C. in cotton of 70% (*8, 9*) and consid-

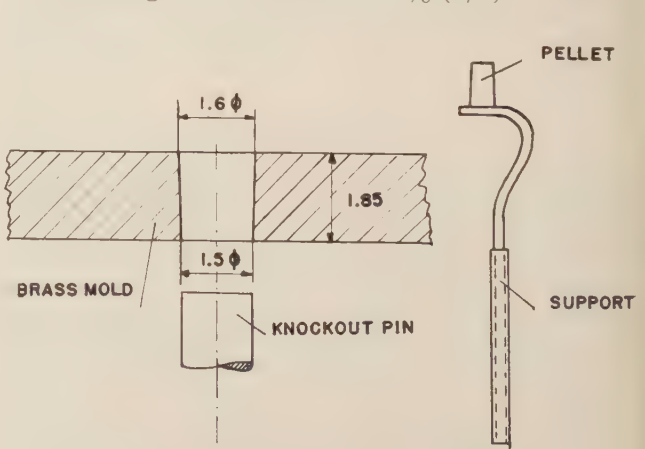

Fig. 1. Mold and support for the fiber pellets

C. F. Wijnman, Laboratory of Technical Botany, The Technical University, Delft, Holland.

Table I. Compilation of Average Data Obtained

Hours beaten or ground	Freeness, °S.-R.	Swelling, %	Per cent of water at 25°C. and 75% R.H.	Degree of cryst. deduced from Sorption ratio, %	Degree of cryst. deduced from X-ray diagram, %	Half-width of 002 peak in mm. on the film	Fluidity rhe's	D.P.
0	0	205	8.7	70	70	2.2	2.2	3000
12 wet	77[a]	274	10.8	63	66	2.5	8.9	1380
23 wet	4[a]	307	12.0	59	65	2.9	13.5	1070
25 dry	...	...	17.3	40	22	...	...	...

[a] See remarks concerning freeness determination.

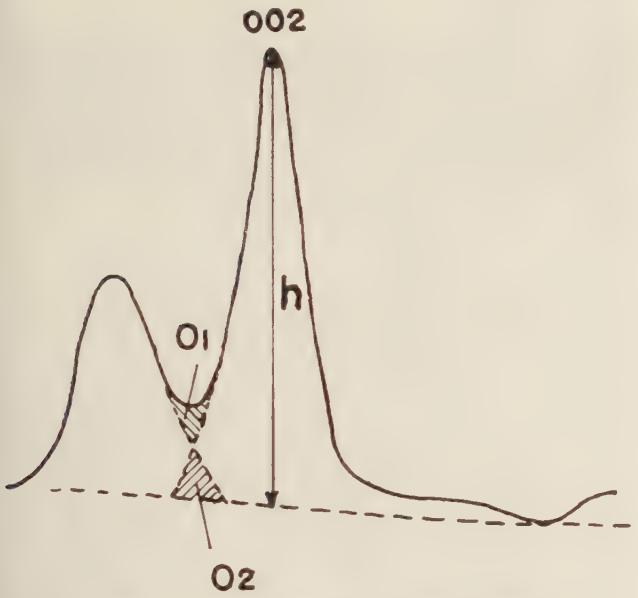

Fig. 2. Determination of half-width

ering that only the amorphous part will absorb water the ratio of the water content at 75% R.H. before and after beating (sorption ratio) may be taken as a measure for the change of the D.C. (*6*, p. 54).

The other method used was based on x-ray ring diagrams of standard fiber-pellets and has been described in detail by Hermans and Weidinger (*8*, *9*). A minor deviation in the method of preparing the pellets appeared to be necessary since the pellets, consisting of small fiber particles, were very delicate and could not withstand manipulation if prepared in the original way. Three milligrams of dry material were placed on a glass plate, moistened with a saturated alcoholic solution of Canada balsam, and pressed down in the hole of a brass-mold as shown in Fig. 1, the plate lying on a flat surface. After drying on a steam bath and cooling, a support (Fig. 1) was fixed to the base of the conical pellet, a drop of molten Khotinsky cement serving as an adhesive, and with the aid of a pin the pellet was carefully extruded from the mold. The trace of Canada balsam left in the pellets for the sake of sufficient strength is so small as to be negligible.

The intensities of the x-ray interferences on the film were measured with a photometer (Fig. 3a–d). As elucidated by Hermans and Weidinger (*8*, *9*) the surface of the peaks and the height of the amorphous background may be taken as relative measures of the crystalline fraction and of the disordered fraction, provided certain corrections are being introduced. All determinations were made in triplicate and the results recorded in a crystallinity nomogram (Fig. 4) as introduced by Hermans and Weidinger. For comparison the D.C. of rayon, known to be about 40%, was also determined and plotted in the nomogram.

Since no pellets could be made from the fine powder obtained after grinding dry cotton in a ball mill, tablets were pressed and used instead of the pellets, and the necessary absorption measurements carried out as described by Hermans and Weidinger (*9*).

Relative Crystal Size

The width of the 002-peak at half-height above the background was measured since it is closely connected with the mean crystal size. An absolute value of the crystal size could not be calculated since the line breadth of the peaks is affected by the large pinhole diameter and the thickness of the pellets. The sides of the 002 and 101 peaks were extended down to the amorphous background as shown in Fig. 2, thereby equalizing the areas 0_1 and 0_2. From the ratio of the area of the 002-peak surface and its altitude the half-width of the 002-peak can be computed.

The Degree of Polymerization

The D.P. of the cellulose was derived from the cuoxam-viscosity as determined according to the Shirley Institute method (*3*, *21*). The D.P. was found using the viscosity conversion chart published by Martin (*15*). The determinations were made in duplicate.

RESULTS

The data obtained are compiled in Table I. In Figs. 3a–d are shown photometer curves of representative x-ray diagrams of untreated, beaten, and dry-milled cotton, respectively. The D.C.'s derived from these curves and those found for a sample of rayon are plotted in Fig. 4. Finally the photomicrographs of Fig. 5 will exemplify the degree of beating that was obtained.

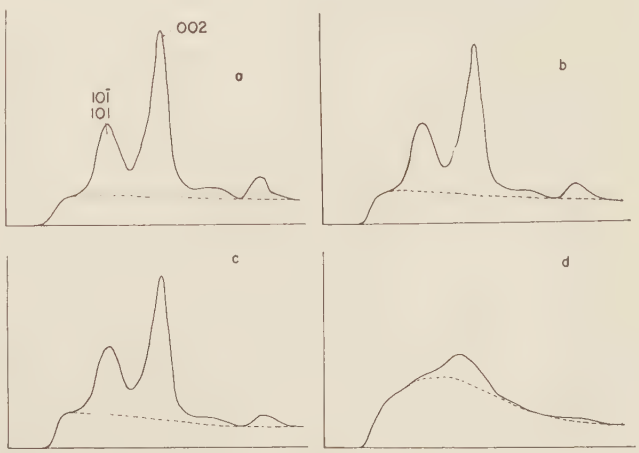

Fig. 3. Photometer curves of x-ray diagrams of: (a) untreated cotton, (b) cotton beaten for 12 hr., (c) cotton beaten for 23 hr., (d) ball-milled dry cotton

DISCUSSION OF RESULTS

Beating of the Fibers

When subjected to heavy beating, cotton fibers show a distinct increase in hygroscopicity, thus causing the D.C. as calculated from this change to fall from 70 to 59%. The same trend is indicated by the data for the D.C. calculated from the x-ray diagrams, but in a far less degree. Somewhat more apparent is the reduction in the relative size of the crystalline regions. Howsmon (*13*) likewise found that there is no strict parallelism between hygroscopicity and crystallinity.

The biggest change is noted in the fluidity, the D.P. being reduced to 46% of the original value after 12 hr. of beating and to 36% after 23 hr. of beating.

Obviously, the cellulose molecules are broken up into smaller parts, and the average size of the crystalline regions reduced considerably without a corresponding decrease of the total crystalline fraction. In other words, the oblong crystalline regions are broken or split without much internal deformation; they are rigid. Probably there is also breakage in amorphous regions.

As appears from the data for the freeness and for the swelling, as well as from the photomicrographs, the beaten cotton fibers have been broken and fibrillated to a very high degree. The D.P. and D.C. changes observed will apply to such a severe beating only. Furthermore it may be appropriate to recall that they were observed with cotton.

Grinding of Dry Cotton in a Ball Mill

As was expected, the D.C. calculated either from the sorption data or from the x-ray diagrams appears to be very much reduced after dry grinding of cotton fibers. Again the two methods produce considerably different data. A similar difference may be found in the data given by Hermans and Weidinger (7). Using rayon ground in dry condition they found D.C.'s of about 9% with their x-ray method, but much higher D.C.'s can be calculated from the sorption ratios given by them.

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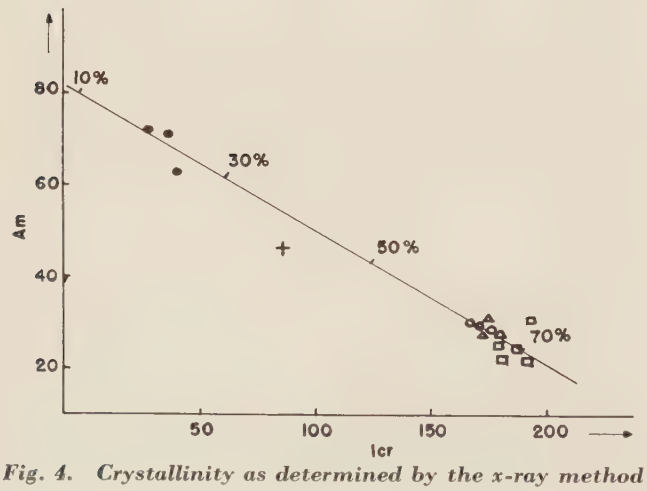

Fig. 4. Crystallinity as determined by the x-ray method

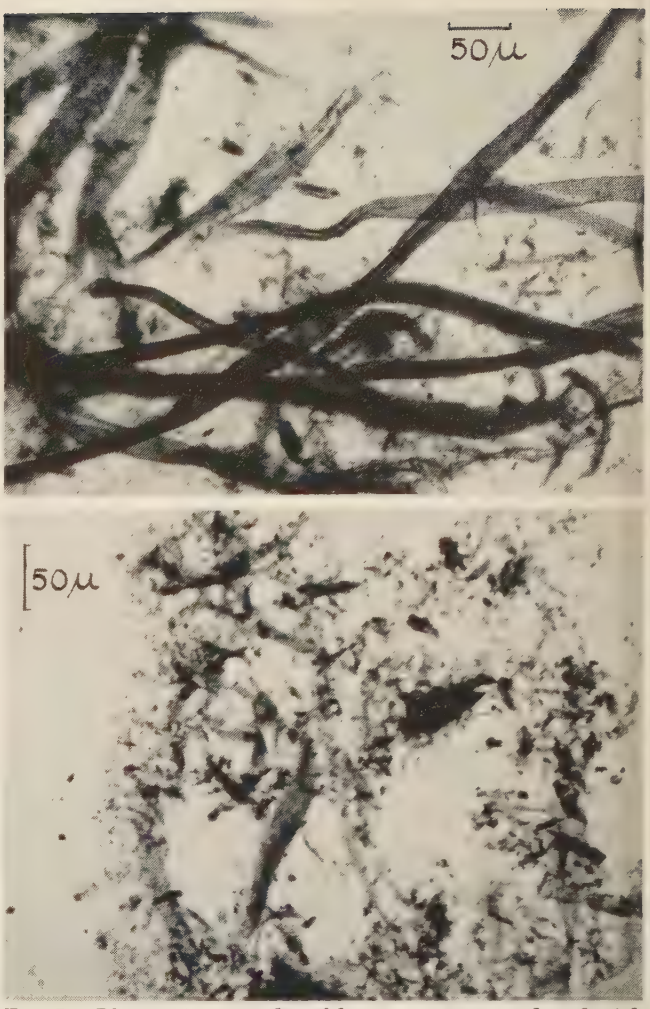

Fig. 5. Photomicrographs of beaten cotton, colored with ChlZnI:(top) beaten for 12 hr., (bottom) beaten for 23 hr.

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The Chemical Composition of Some Leaf and Bast Fibers

E. C. LATHROP and G. H. NELSON

Proximate chemical analyses are presented for 15 of the more common bast and leaf fibers. These fibers are uniformly low in lignin and high in cellulose contents. The leaf fibers are higher in pentosan content than the bast fibers, but lower than cereal straws and bagasse. Since bast and leaf fibers could contribute high-tearing strength to specialty papers made from them, some small-scale preliminary pulping experiments are reported. Chemical requirements for pulping seem to be lower and pulp yields higher than indicated in the older literature.

Leaf and bast fibers have found important uses in the manufacture of many of the strongest, most resistant, permanent, and fine papers. For many years linen rags were the base material for the manufacture of ledger, bond, and cigarette papers. More recently seed-flax-straw tow has supplemented and replaced linen rags for making cigarette, condenser, fine book, and writing papers. It is also used in making safety papers and to increase scuff resistance in currency paper.

Leaf fibers have been used in the paper industry, particularly to make papers resistant to tear and rough usage. An outstanding example is the use of pulp from old rope in making flour-sack paper.

A paper mill, with a capacity of 3000 tons of kraft paper per year from the short waste fibers of abaca produced in the manufacture of manila hemp (*1*), has recently begun operations in Costa Rica.

Leaf and bast fibers generally produce pulps composed of long fibers having narrow fiber diameter and high strength. The increasing demand for strong specialty papers will likely result in greater consumption of both of these classes of fibers. They are produced in many countries where long-fibered pulpwood is not easily available, and their use in pulps as blends with short-fibered hardwood or agricultural residue pulps suggests a means of manufacturing strong wrapping, bag, and specialty papers from these mixtures (*2*).

There is very little information available in the more recent literature on the chemical composition of these kinds of fibers. The information in the older literature is scattered and in many cases is found in journals available only in a few places. Frequently, the details of the methods of analysis used are not reported or the methods are outdated.

For one reason or another, during the past few years authentic samples of some of these fibers have come to the attention of the Northern Regional Research Laboratory. These samples have been analyzed and enough data have been assembled to show that the older data on pulping may not be reliable. It is expected that from time to time the Laboratory will publish further data on leaf and bast fibers. The analytical data presented have been obtained by the same group of workers who have contributed so much to similar studies on agricultural residues.

E. C. Lathrop, Head, and G. H. Nelson, Chemical Engineer, Agricultural Residues Div., Northern Regional Research Laboratory, Peoria, Ill., one of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Service, U. S. Department of Agriculture.

SOURCE OF SAMPLES

The various samples of abaca, henequen, and sisal were secured from large commercial lots imported by the Peoria Cordage Co. The sample of abaca waste was shipped from the Costa Rica plant producing abaca fiber for the Reconstruction Finance Corp. The sample represented the waste produced in the decorticating process and was collected for a cooperative study of fiber recovery carried on by the Northern Laboratory and the Armour Research Foundation on behalf of the RFC. The material was treated in Costa Rica with lignasan for the purpose of preservation and was shipped in steel drums in a wet condition. The sample of marine rope was secured from the Peoria plant of the Bemis Brothers Bag Co. and was representative of the old manila (abaca) rope which was being pulped by this company.

The samples of kenaf fiber and kenaf waste and the ramie fiber were secured from R. V. Allison, vice-director of the Everglades Experiment Station, Belle Glade, Fla. These samples were representative of large experimental lots of these fibers grown and prepared by that station.

The sample of caroa fiber was received from the Minnesota Mining and Manufacturing Co. and was imported from Brazil.

The analyses of the bast fibers from seed-flax straw and hemp (*Cannabis sativa*) are reported in the literature (*3*, *4*) and were carried out by the Forest Products Laboratory. These data are included for ready reference.

EXPERIMENTAL

The air-dried samples were prepared for analysis by grinding in an Abbe mill using a screen with $^1/_4$-in. holes. The samples were then mixed and quartered and ground in a Wiley mill to pass a 1-mm. round-hole screen.

Ash, pentosans, extractives, e.g., solubility in hot water, alcohol-benzene, and 1% NaOH, and Cross and Bevan (C and B) cellulose were determined according to the methods of TAPPI. Lignin and monoethanolamine (MEA) cellulose were determined according to methods previously described (*5*).

DISCUSSION OF ANALYTICAL RESULTS

The leaf fibers, with the exception of caroa, are low in ash content and are comparable with pulpwoods in this respect. The bast fibers, however, have ash contents more of the order of cereal straws. It should be possible to produce pulps from leaf fibers of extremely low ash content which is an important property of dissolving pulps.

Table I. Proximate Chemical Analyses of Leaf and BastFibers[a]

Fiber	Botanical name	Area of production	Ash, %	Lignin, %	Pentosans,[b] %	Extractives: Hot water, %	Extractives: Alcohol benzene, %	Extractives: 1% NaOH, %	Cross and Bevan cellulose: C and B cellulose Ash-free, %	Cross and Bevan cellulose: C and B cellulose Pentosans in, %	Cross and Bevan cellulose: Alpha as run Ash-free, %	Cross and Bevan cellulose: Alpha as run Pentosans in, %	Cross and Bevan cellulose: Alpha-basis, original—ash and pentosan free, %	Monoethanolamine cellulose: MEA cellulose Ash-free, %	Monoethanolamine cellulose: MEA cellulose Pentosans in, %	Monoethanolamine cellulose: Alpha as run Ash-free, %	Monoethanolamine cellulose: Alpha as run Pentosans in, %	Monoethanolamine cellulose: Alpha basis, original—ash and pentosan free, %
Leaf																		
Abaca (manila)	*Musa textilis*	Philippines	1.1	8.8	17.3	2.1	2.0	18.8	78.1	16.4	81.6	4.6	60.8	76.9	15.6	84.2	4.0	62.1
Abaca waste	*Musa textilis*	Costa Rica	1.3	10.5	21.1	2.5	2.0	24.9	69.9	19.5	75.3	7.0	48.9	68.3	16.7	84.4	6.9	53.6
Abaca (marine rope)	*Musa textilis*	...	1.6	10.3	17.4	0.5	1.1	18.5	71.5	16.3	77 9	2.8	55.7	73.9	16.4	82.6	4.7	61.0
Henequen	*Agave fourcryodes*	Yucatan	0.6	9.6	24.5	2.1	1.1	15.2	68.0	23.9	77.8	9.0	48.1	73.3	28.1	83.9	15.7	51.8
Henequen	*Agave fourcryodes*	Cuba	0.7	7.8	23.6	2.7	1.6	15.5	73.4	21.2	82.6	10.0	54.5	75.5	25.6	82.3	12.3	54.5
Sisal	*Agava sisalana*	Africa	0.6	7.6	23.4	1.6	1.1	14.3	76.1	22.4	79.3	9.7	54.5	76.3	24.4	84.0	12.7	55.9
Sisal	*Agava sisalana*	Brazil	1.1	8.1	21.3	4.9	1.7	17.2	72.8	21.4	81.0	8.1	53.6	73.7	23.7	93.5	18.7	56.1
Sisal	*Agava sisalana*	Haiti	0.6	9.2	24.1	1.6	0.9	12.6	73.4	24.3	78.2	8.5	52.6	74.9	26.1	82.8	14.5	53.0
Caroa	*Neoglazovia varigata*	Brazil	3.1	9.6	16.5	20.0	8.9	37.5	55.7	15.0	77.2	4.2	41.2	56.5	16.2	84.0	8.8	43.3
Bast																		
Kenaf	*Hibiscus cannabinus* L.	Florida	1.0	10.4	19.1	1.7	0.7	16.2	71.9	18.6	73.6	2.8	51.4	71.6	19.3	79.0	4.6	54.0
Kenaf waste (ribbon decorticator)	*Hibiscus cannabinus* L.	Florida	2.4	12.4	18.5	3.5	1.7	21.8	65.3	18.3	71.6	2.1	45.8	64.8	19.3	75.0	4.8	46.3
Kenaf waste + whole stems	*Hibiscus cannabinus* L.	Florida	2.5	20.8	16.2	5.9	3.9	24.6	55.4	21.7	71.0	2.7	38.3	56.3	24.8	73.1	4.9	39.1
Ramie	*Boehmeria nivea*	Florida	2.0	1.7	5.3	5.7	1.4	19.5	85.4	3.8	86.9	2.6	72.2	82.0	2.6	88.3	1.4	71.4
Hemp tow (*4*)	*Cannabis sativa*	Wisconsin	5.3	7.3	6.3	12.0	12.0	29.5	61.2	2.4	..	..	58.8	.	..	..	..	..
Seed flax tow (*3*)	*Linum usitatissimum*	Minnesota	4.7	10.1	6.0	11.1	2.3	29.2	71.9	3.4	..	..	68.5	..	..	..	..	..
Seed flax tow (1947)[c]	*Linum usitatissimum*	Minnesota	4.6	11.5	15.7	6.3	5.3	27.4	59.4	12.7	79.2	2.5	45.8	56.6	12.9	79.6	3.3	43.6
Seed flax tow (1951)[c]	*Linum usitatissimum*	Minnesota	2.3	14.5	17.4	8.0	3.5	28.3	61.2	14.1	75.9	3.1	45.1	63.9	14.1	75.6	3.0	46.9

[a] Basis oven-dry samples.
[b] Pentosans = furfural × factor 0.8.
[c] Representative of commercial tow used by paper mills to make cigarette, condenser, and fine papers; probably contains 25 to 30% woody shive in bast fiber.

Table II. Small-Scale Pulping Tests on Some Leaf and Bast Fibers[a]

Material used	Cooking conditions: Cooked in	Cooking conditions: Temperature, °C.	Cooking conditions: Time, hr.	Cooking chemical: Chemical used	Cooking chemical: Per cent used	Pulp yield: Crude, %	Pulp yield: Screened, %	Strength characteristics of the unbeaten pulp: Basis weight (25 × 40 −500), lb.	Strength characteristics of the unbeaten pulp: Bursting strength, pt./ream, lb. × 100	Strength characteristics of the unbeaten pulp: Tensile strength, g./ream, lb.	Strength characteristics of the unbeaten pulp: Tear resistance, g./ream, lb. × 100	Strength characteristics of the unbeaten pulp: Folding endurance, Schopper double folds	Strength characteristics of the unbeaten pulp: Apparent density, g./ml.	Chemical components of pulp: Ash, %	Chemical components of pulp: Lignin, %	Chemical components of pulp: Pentosans,[b] %	Bleachability: Stages used	Bleachability: Cl_2 consumed, %	Bleachability: Brightness, %	Bleachability: Yield basis original %
Abaca (marine rope)	Small Hydrapulper	98	1	NaOH	12.0	...	79.1	...	...	...	...	...	...	2.4	12.8	31.0	Three	7.5	70	74.9
Abaca (marine rope)	DynoPulper	98	1	NaOH	10.3	80.0	77.2	...	...	...	...	...	...	1.8	6.2	17.0	Single	4.4	70	70.5
Henequen (Cuba)	Small stainless steel digester	170	2	NaOH	15.0	72.3	. .	49.4	59.5	99	322	200	0.476	...	2.0	...	Single	1.1	72.2	67.4
Henequen (Cuba)	Small stainless steel digester	170	2	NaOH	20 0	67.3		17 5	75 8	109	398	411	0.478	. .	1.8	...	Single	0.4	76.7	64.5
Sisal (Brazil)	Small stainless steel digester	170	1	NaOH	15.0	75.2[c]	...	47.6	48.1	111	419	60	0.454	1.5	4.0	19.9	Single	2.4	64.1	74.2
Sisal (Brazil)	Small stainless steel digester	170	3	NaOH	20.0	65.6[c]	...	47.3	62.2	102	449	173	0.467	1.5	2.9	19.3	Single	1.2	66.2	64.8
Caroa fiber (as received)	50-gram Hydrapulper	98	1	NaOH	14.7	61.5	...	48.0	80.2	110	392	1541	0.531	..	..	...	...	...	...	..
Caroa fiber (cut to pass 4-mesh and be retained on 20-mesh screen)	50-gram Hydrapulper	98	1	NaOH	15.0	63.4	...	46.9	90.0	115	381	1549	0.519	1.0	6.1	15.8	Single	2.8	67.0	62.7
Kenaf fiber	50-gram Hydrapulper	98	1	NaOH	15.0	83.4[c]	...	46.8	124.0	184	175	666	0.619	1.3	10.3	16.9	Single	3.0	59.5	81.1
Kenaf waste	50-gram Hydrapulper	98	1	NaOH	15.0	69.9[c]	...	48.3	67.7	133	106	141	0.607	2.3	17.9	19.2	Single	9.9	56.2	68.3

[a] Basis oven-dry samples.
[b] Pentosans = furfural × factor 0.8.
[c] Pulp was defibered in small Bauer mill.

All of the materials, excepting the kenaf waste plus whole stems, are low in lignin. In fact, they usually contain half or less than half the lignin content of pulpwoods and many agricultural residues. Since lignin is the principal constituent that must be removed in producing fine pulps, it would seem all these fibers, with the exception of the whole-stem kenaf waste, should pulp rather easily. The woody stems of the plants from which bast fibers are obtained have much the same chemical composition as the temperate zone hardwoods and generally pulp with about the same conditions of chemical concentration, time, and temperature as these pulpwoods.

There is a notable difference in pentosan content between the bast and leaf fibers. With the exception of the kenaf samples, the pentosan content of the bast fibers is quite low, lower than that of the coniferous pulpwoods. On the other hand, the pentosan content of the leaf fibers and kenaf is of the same general order as that of many temperate zone hardwoods and lower than the pentosan content of the cereal straws, sugarcane bagasse, corn or sorghum stalks, esparto, reeds, and the like. Low-pentosan pulps can be prepared from most of the bast fibers. Because of their low pentosan content, such pulps will require considerable beating and should produce papers of good opacity. Taking into account both the low lignin and pentosan content, it is easy to see why linen rags have always been so highly prized by the papermaker for producing strong permanent ledger, book, condenser, and cigarette papers. Enough experience has been accumulated to show that many other bast fibers may be useful for papers of these types. From the practical standpoint, it is difficult to obtain bast fibers at low cost, excepting when they are produced as a waste or when they are produced with a minimum of retting. The mechanical separation from the woody stem portion of the partially retted bast fibers is difficult so that, depending on conditions, more or less of the woody material must be pulped along with the bast fiber. Since the conditions suitable for pulping the bast fiber will not pulp the woody material, frequently conditions must be chosen so that the woody material will pulp. This results in degradation of the bast fiber with consequent lower yields and pulps of lower quality than may be obtained from the bast fiber itself. The solution of this problem would be of considerable importance.

Unless drastic cooking conditions are used in pulping the leaf fibers, the pentosan content of pulps made from them will correspond somewhat with that of hardwood pulps, with the result that these pulps will not require as much beating as pulps made from softwoods. The low lignin contents of the leaf fibers would seem to indicate low chemical requirements and mild pulping conditions. However, in using decorticating waste from leaf fibers, other problems arise. The fleshy leaf material in which the fibers are embedded is difficult to remove. A comparison of the analysis of the abaca fiber with the abaca waste from Costa Rica shows that this fleshy material contains more lignin, more pentosans, less cellulose, and a higher percentage of extractives. When this sort of waste is dried, the fleshy material shrinks into small disorganized masses which can be shaken loose to a considerable extent and separated by screening. In the cooperative study for RFC, referred to above, it was found that a good separation of this fleshy material could be obtained by chopping the wet waste into lengths of about 1 to 1.5 in. and treating the mass in a Hydrapulper in the presence of water. The mechanical action rubs the material from the fibers. By flushing the mass with water, the dirty fleshy material is washed through the extraction plate. The fibers are mechanically removed from the pulper in a very clean condition, suitable for producing fine pulp.

The extractives from these fibers, particularly in alcohol-benzene and 1% NaOH, with some exceptions, are comparatively low. Based on the high percentages of extractives, the caroa fiber appears to be rather impure. In general, the bast fibers contain higher percentages of extractives than the leaf fibers, in spite of the fact that the bast fibers are generally lower in pentosans.

The percentage of C and B or MEA cellulose in these fibers is uniformly high and, in general, the alpha-cellulose content on an ash-free and pentosan-free basis is high. As previously noted, these fibers in cleaned condition, should produce high-strength pulps in very high yields.

An intercomparison of the various samples of sisal and henequen, and of abaca with marine rope, shows that the chemical composition of these are quite similar. There is not quite the same uniformity of composition between the bast fibers. The ramie fiber is undoubtedly the purest since it has been degummed. The other bast fibers still contain to some extent the so-called gummy materials, since they have been subjected only to the casual field retting that takes place during collection of the stalks.

PULPING EXPERIMENTS

All of these fibrous materials, with the exception of kenaf waste, are quite low in lignin content and might be expected to pulp rather easily, requiring low amounts of chemicals in cooking and producing pulps in high yields. The few reports in the literature indicate that this is not the case, and indeed high amounts of chemicals have been required and in most cases the yields have been relatively low.

For example, Shaw (*6*) and co-workers pulped shredded caroa fiber using 15 to 25% caustic and 120 lb. pressure for a period of 4 hr. They report yields of from 39 to 49% by this procedure. When retted caroa fiber was used, yields of 60 to 67% were obtained. The strength properties of these pulps were fairly good but 13% or more of chlorine was required to obtain bright pulps. More recently Sproull (*7*) in an attempt to produce condenser paper from caroa fiber used a two-stage cooking process in the first stage of which the soluble material was washed out with boiling water and in the second stage a cook at slightly above atmospheric temperatures using 21% caustic on the basis of dry material was carried out. A pulp yield of 50% is reported and the paper made from the pulp was quite uniform and compared well in properties with conventional 0.003-in. paper for insulation purposes.

Shaw and Bicking (*8*) also report studies on pulping manila rope (abaca). The rope was cooked at 135 to 145 lb. pressure for 5 hr. using 25% caustic on raw material and a yield of 35% of pulp was obtained. The paper made from this pulp was of only moderate

strength. Old rope is commercially pulped for the manufacture of flour sacks. The conditions used in the commercial pulping of this material are: cooking for 9 hr. at 22 to 40 lb. with a mixture of soda ash, trisodium phosphate, and sodium sulphite, 4%, and from 3 to 7% caustic soda depending on the estimated percentage of sisal mixed with abaca in the rope.

As is well known, seed-flax straw is used annually to the extent of several hundred thousand tons for the manufacture of cigarette and other fine papers. Flax-straw tow contains a certain amount of woody material which cannot be separated easily and cooking conditions must be arranged so as to pulp this woody material. Pulping conditions are said to be 20 to 22% caustic soda plus about 3% sulphur for 5 to 6 hr. at 150 to 160°C. The yield based on the material added to the digester is reported to be about 43%. The pulp produced may be bleached to a brightness of 80 in the conventional three-stage system using about 10% of chlorine.

Since high-strength, easily hydratable pulps can be manufactured from both cereal straws and sugarcane bagasse by the mechano-chemical process, it would appear that such pulps would be particularly suitable for blending with pulps from bast or hard fibers to produce strong, tear-resistant specialty papers. It seemed desirable, therefore, to carry on some small-scale laboratory cooks on a few of the bast and hard fiber samples to determine the general range of conditions required to produce satisfactory pulps. The high-pressure cooks were made in a 2-qt., stainless-steel digester which was heated in an oil bath. The atmospheric-pressure cooks were made according to the mechano-chemical process in either a 2-qt. laboratory Hydrapulper or in a 2-gal. DynoPulper. Handsheets were made from unbeaten pulps but in a number of cases the pulps were too fibrous to be capable of sheet production, and those pulps were run through a small Bauer mill to thoroughly defiber them. The data obtained in this preliminary pulping study are presented in Table II.

The fibers from abaca, caroa, and kenaf pulped easily and it was necessary only to use atmospheric cooking in the small Hydrapulper. Pulp yields of about 80% were obtained from abaca using 10 to 12% caustic. These pulps bleached easily, although in one case the lignin content of the pulp was about 12%. Yields of pulp from caroa fiber were slightly more than 60% and the pulp bleached easily. The pulps produced from caroa fiber are fairly strong and this fiber looks quite promising for making specialty papers.

Recently some interest has been expressed in the possibility of obtaining pulps from waste kenaf tow and from kenaf waste which contains a certain amount of woody stem material. It was found that both kenaf fiber and kenaf waste could be pulped in the small Hydrapulper using 15% caustic. Unexpectedly, the woody portion of the kenaf waste seemed to pulp rather well at atmospheric pressure. It was necessary to defiber both of these types of pulp by the use of the small Bauer mill, and the strength properties of the pulps are rather good. Although the pulps obtained were rather high in lignin, it is indicated that it would be practical to pulp these materials by the mechano-chemical process to produce strong pulps.

Henequen and sisal fibers could not be pulped satisfactorily by the mechano-chemical process and pressure cooks were required to obtain pulps. It is indicated that from 15 to 20% caustic soda will be required for pulping these fibers at a temperature of about 170°C. The pulps obtained were defibered through the small Bauer mill and yields from 63 to 75% on the basis of original fiber were obtained. The pulps bleached rather easily and the strength characteristics of these pulps are good.

In considering these data, it must be recognized that they are of the most preliminary character, but they do indicate that pulps can be produced at a lower chemical requirement and under less severe conditions of cooking than might be expected from the earlier reports in the literature. On the other hand, they seem to require more severe conditions in pulping than might be expected from their lignin contents. It is possible that this may be due to the physical character of the fibers which makes diffusion of the cooking chemicals into them slower or more difficult. In considering the strength characteristics of the pulps, the high tearing resistance is perhaps the most striking property. The formation of the handsheets from most of these pulps was poor. This is to be expected from long-fibered pulps. Our experience in making blends of short-fibered, agricultural residue pulps with long-fibered pulps, such as softwood kraft, has demonstrated that the presence of the agricultural residue pulps greatly improved formation of sheets and that stronger papers were produced from blends of the kraft pulps with about 25% agricultural residue fiber than from the kraft pulps alone. On this basis it is suggested that further studies to determine the usefulness of pulps from bast or hard fibers should take into account the possibility of obtaining increased strength by the use of small percentages of added agricultural residue fibers.

SUMMARY

Bast and hard fibers may find future use in the manufacture of specialty papers, particularly where high tear resistance is required. Proximate analyses made on 15 of these show that they are all low in lignin and high in cellulose contents. Bast fibers contain less pentosans than leaf fibers. Preliminary small-scale pulping tests indicate that chemical requirements may be lower and pulp yields higher than is indicated for these materials in the older literature, but chemical requirements seem to be higher than would be expected from lignin content. This might be due to the physical composition of these fibers.

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The mention in this article of commercial products under proprietary names or companies does not constitute an endorsement by the U. S. Department of Agriculture.

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Phase Contrast Microscopy of Beaten Pulp

G. VAN NEDERVEEN and J. ISINGS

Beaten pulps were studied with the aid of the phase contrast microscope. This instrument reveals much more about the structure of the fibrils than does the ordinary microscope. Phase contrast micrographs of pulps originating from different sources and beaten in a laboratory Hollander, a Lampén mill, and a Turmix are given. Rag fibers when beaten are found to give only one-dimensional fibrils. Beating of wood and straw pulps causes principally the disintegration of the cell wall material, resulting in skins which on a nearer inspection consist of linear fibrils still having a lateral cohesion. In some cases fibrils apart from the skins were observed. These proved to be "rolled-up" skins. Consequently the lateral fibrillar cohesion of rag fibers seems to be less strong than that of wood and straw pulp fibers.

Except for the electron microscope which is too complicated for the papermaker, only the ordinary microscope has been available for the investigation of fibers and the effects of beating. In the last few years, however, it has been possible to study fibers with the phase contrast microscope developed by Zernike (*1*). This apparatus gives a much clearer picture of the structure of fibrous material than does the ordinary microscope, showing more details, without any difficulty of interpretation. It is believed that this new tool is a very valuable addition to the papermaker's laboratory.

In this paper some micrographs taken in phase contrast are shown in comparison with pictures from the ordinary microscope, and evidence is presented that the phase contrast microscope gives more insight into the effects of beating than can be obtained by normal microscopy.

Recently one of the authors published the results of a comparative study of various laboratory beating equipment (*2*) in which softwood sulphite pulp was beaten. The beating action of a Lampén mill, a small type Jokro mill, a Turmix kitchen aid (12,000 r.p.m.), and a laboratory Hollander of the Niagara Valley type was compared and it was found that these beaters attacked the fiber wall to different extents when compared at the same freeness. This was demonstrated by observations under the ordinary microscope after a partial swelling of the beaten material in diluted cuprammonium solution. Beating in the Lampén mill was shown to have a strong bruising and shortening effect. This clearly followed from the fact that a large number of swollen regions on the cell wall were observed after beating. The damaged parts of the cell wall showed a markedly fibrillar structure; also observed were a few very thin skins, i.e., membranelike pieces of cell wall material, which were very difficult to distinguish. In not one of the slides were the threadlike fibrils known from rags found. Beating in the Turmix caused much less damage than did beating in the Lampén mill, there being found few swollen regions, a less markedly fibrillar structure of the spots damaged, and also a smaller proportion of skins.

In order to obtain a low freeness after beating and handsheets with good strength, it is necessary to have well-developed fibrillation (fibrils or membranes). The microscopical picture for the most part, however, does not show either sufficient fibrils or skins, and therefore, does not give a satisfactory explanation of the high beating degree obtained (60°S.R.) and the strength of the sheets of wood and straw pulp.

The phase contrast technique seemed to offer the most promise for the investigation of this problem and the micrographs obtained confirmed this. A Leitz Wetzlar phase contrast microscope was available; for the theory of phase contrast the reader is referred to the textbooks (*3*).

The fibers photographed were embedded in a mixture of glycerin and gelatin as without that technique no sharp pictures are obtained, the very thin fibrils being constantly in a slight motion (Brownian movement and thermal convection). The other slides were made in the ordinary way in water without dyeing or drying. The microscope used allowed ordinary observation and study in phase contrast alternatively without changing the position of the slide.

In Figs. 1 to 20* microphotographs of rag fibers (cotton and linen), softwood and hardwood sulphite, and straw pulp fibers after beating in one of the apparatuses mentioned, in phase contrast and also when necessary for comparison in normal light are presented.

RAGS

Figure 1 shows linen fibers from new linen rags, beaten in the laboratory Hollander to 50°S.-R. All fibers show a strong internal fibrillation; many linear fibrils, loosened from the stem of the fibers, are also seen.

In Fig. 2 the same kind of fibers are given, beaten to 80°S.-R. in the laboratory Hollander. A large amount of loosened linear fibrils and strong internal fibrillation but no skins are observed.

Cotton rags, beaten in a laboratory Hollander to 50°S.-R., are shown in Fig. 3. Here a very intense external, linear fibrillation had been obtained.

The same cotton rags are shown in Fig. 4, this time beaten in the Lampén mill to 80°S.-R. after beating in

G. Van Nederveen and J. Isings, Vezelinstituut T.N.O., Delft, Holland.

* All pictures are authentic photographs of the Vezelinstituut T.N.O.

the Hollander to 50°S.-R. The fibrillation is very marked.

No skins were observed in these studies of rags.

SOFTWOOD SULPHITE PULP

Figure 5 shows a picture of unbeaten pulp. There

Fig. 1. Linen fibers beaten in laboratory hollander to 50°S.-R. (350×)

is no significant difference of this phase contrast photograph with those from ordinary microscopy. Some fibers are bruised locally and show internal fibrillation but no external fibrils are found.

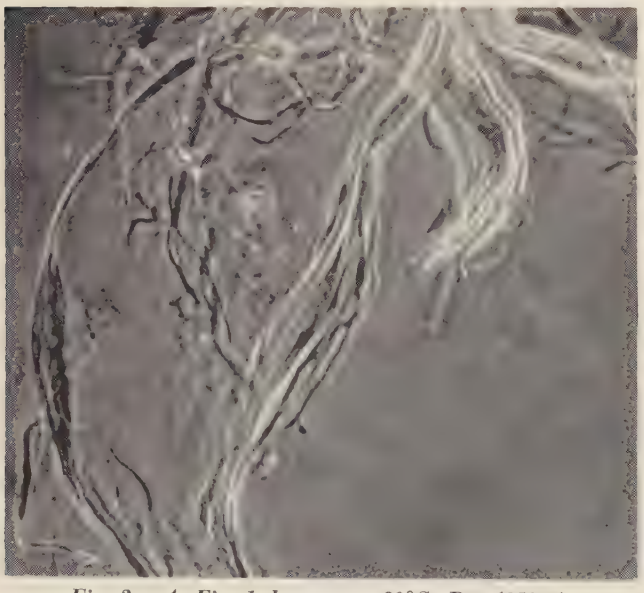

Fig. 2. As Fig. 1, beaten to 80°S.-R. (350×)

The significance of microscopy in phase contrast is demonstrated in Figs. 6 and 7.

Figure 6 shows softwood sulphite pulp after beating in a Lampén mill to 59°S.-R. as observed in an ordinary microscope. In addition to only slightly damaged fibers there is seen an amount of "pulp slime." This slime shows only vague contours with no structural elements.

Figure 7 gives the same slide in phase contrast. Now

Fig. 3. Cotton rags beaten in laboratory hollander to 50°S.-R. (175×)

it is clearly seen that the "slime" consists of skins, two-dimensional pieces of cell wall material. These skins overlap more or less. Furthermore, short fiber-like rods are found, which are formed by rolling up of

Fig. 4. As Fig. 3, once more beaten, this time in Lampén mill to 80°S.-R. (175×)

thin pieces of skins. This rolling up is often seen very well when slides are made in water instead of with the viscous glycerin gelatin mixture. There are no linear fibrils in this slide.

After beating the same pulp in a laboratory Hollander to 82°S.-R. Fig. 8 was obtained. Very many

membranes are present in addition to short rolled-up skins which could be mistaken for linear fibrils.

Figure 9 gives another picture of the same material. The fibers show a strong internal fibrillation, and also

Fig. 5. Unbeaten softwood sulphite pulp (phase contrast) (350×)

much shortened material is seen, which again consists of rolled-up skins. When this pulp was beaten again up to 92°S.-R. the picture shown in Fig. 10 was obtained where the fibers are disintegrated to such a degree

Fig. 6. As Fig. 5 after beating in Lampén mill to 59°S.-R. (ordinary microscope) (175×)

that practically all the material is seen in the form of skins. The skins are not uniform in thickness but show folds and wrinkles. On a nearer inspection they are seen to originate from overlapping and partial rolling up of the skins. At some regions a part of a single flat skin can still be observed, which is very thin (for theoretical reasoning approximately 100 A).

Phase contrast microscopy can also throw light on the differences in the beating action between the Lampén mill, the Hollander, and the Turmix, differences mentioned in the introduction.

HARDWOOD PULP

Figures 11 to 15 are micrographs of aspen pulp.

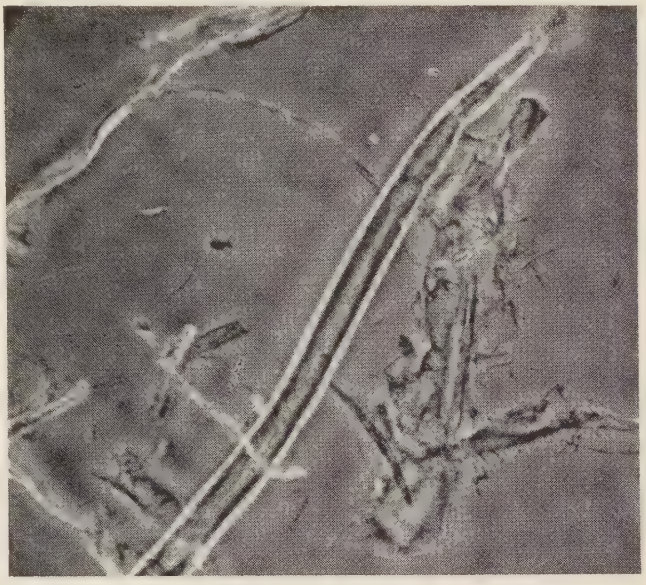

Fig. 7. As Fig. 5, in phase contrast (175×)

Figure 11 gives a picture of the unbeaten hardwood pulp in an ordinary microscope. The fibers show only little internal fibrillation and no externals fibrils. In the

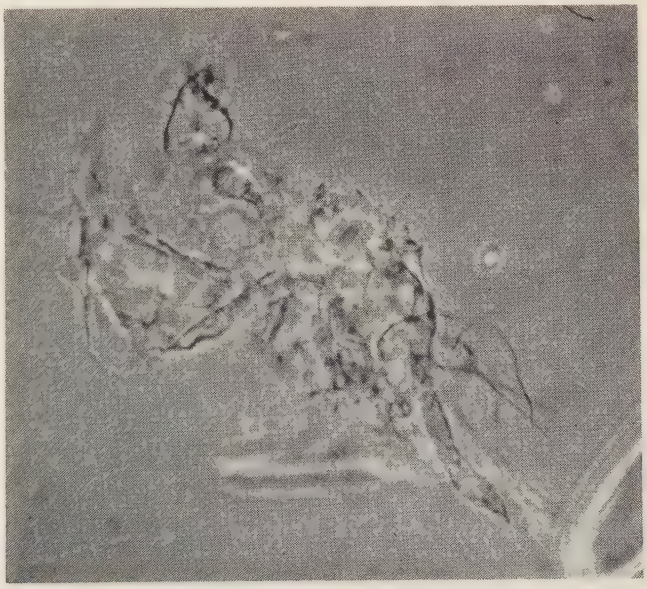

Fig. 8. As Fig. 5, beaten in laboratory Hollander to 82°S.-R. (phase contrast) (350×)

wood vessel various structural details are seen, the meaning of which is not very clear. The nature of the dark lines at the bottom left and the fragment, adhering to the cell wall at the top right, can only be guessed.

The middle part of the vessel does not show any details.

Figure 12 is the same picture but now in phase contrast. The peculiarities of the structure of the fibers are more distinct, but especially there are to be observed more details in the vessel and they are more easy to interpret. The dark lines from Fig. 11 are seen to be different in origin; one is a tear in the cell wall, one is a thicker region, and the last is a wrinkle in the wall. The fragment adhering to the vessel is a part of the wall that has been torn off and rolled up but still is sticking to the vessel. In the lower part of the wood vessel various folds and fine capillaries are seen.

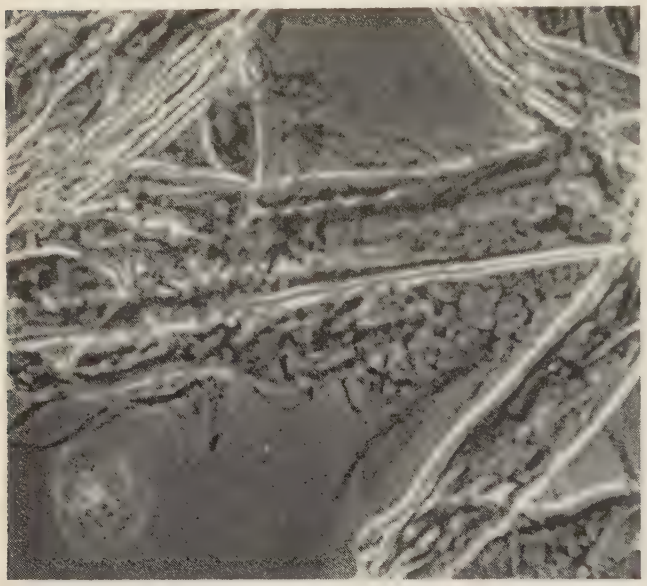

Fig. 9. Another region of the same slide as given in Fig. 8 (phase contrast) (350×)

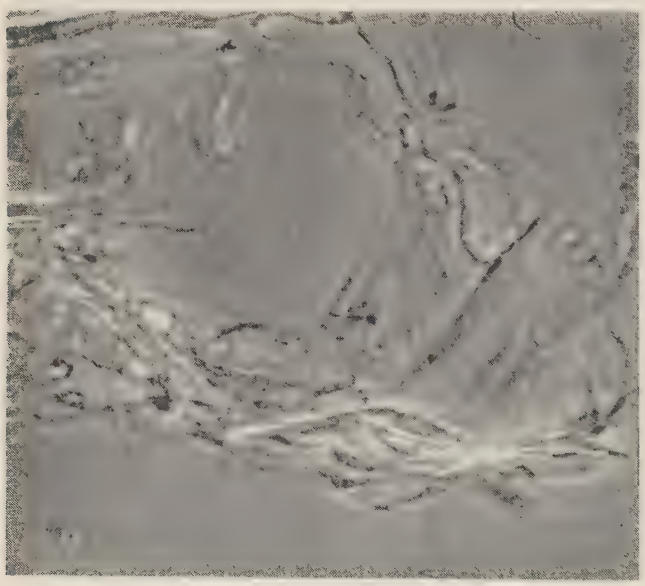

Fig. 10. As Fig. 9 beaten to 92°S.-R. (350×)

Figures 13, 14, 15 show the same pulp after beating in different ways. Figure 13 gives the pulp beaten in the Lampén mill to 31°S.-R. Here some fibers with internal fibrillation are seen but characteristic are large membranes with many folds and wrinkles. Many relatively thick membranes overlap locally. They are partially rolled up and folded. There are practically no fine fibrils.

Fig. 11. Unbeaten hardwood pulp (ordinary microscope) (175×)

Beating in the laboratory Hollander (57°S.-R., Fig. 14) gives another picture. In general, the skins are thinner and less folded or wrinkled. There is more internal fibrillation. The Turmix (Fig. 15, 48°S.-R.) which has a very mild beating action, produces very few skins and these are very thin. Some of them are rolled up and appear as fibrils. The fibers themselves are practically undamaged and internal fibrillation is only insignificant.

Fig. 12. As Fig. 11, in phase contrast (175×)

The micrographs shown all referred to the common well-known materials for papermaking, viz., rag and wood pulp. It is interesting to see how fibrillation

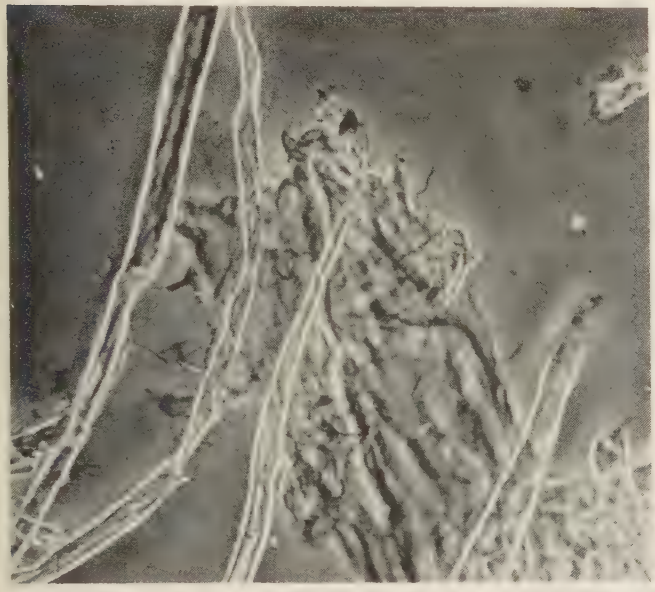

Fig. 13. Same hardwood beaten in Lampén to 31° (175×)

proceeds in the beating of bleached straw pulp. In the Netherlands three kinds of straw pulp are available, each cooked in a different way: viz., by the monosul-

Fig. 14. The same hardwood beaten in laboratory Hollander to 57°S.-R. (350×)

phite process, by the sulphate process, and by the Pomilio Celdecor process.

Figure 16 shows that bleached straw pulp, cooked by one of the alkaline processes, if beaten in the Lampén mill to 38°S.-R., also has a distinct internal fibrillation, and produces skins. With this pulp, however, the skins not only originate from the fiber cell wall, but also from the parenchyma cells present in the pulp.

Figure 17 finishes the proof that these parenchyma cells with their very thin cell wall fibrillate rather easily. The alkaline cooked straw pulp shown in this photomicrograph was beaten in the Turmix to 54°S.-R. The fibers themselves do not yet show any external and only a trace of internal fibrillation, but in the middle

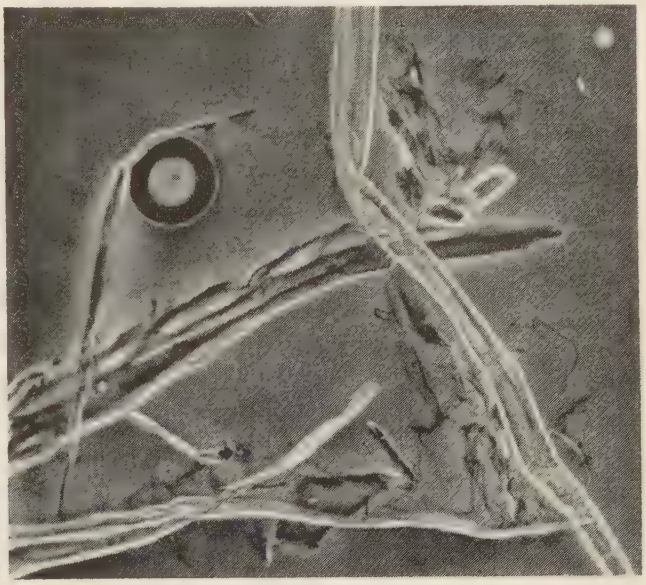

Fig. 15. The same hardwood pulp beaten in Turmix (48°S.-R.) (175×)

of the picture a wrinkled parenchyma cell can be observed.

Figure 18 is a micrograph of the same sample. Here the parenchyma cell is enlarged to a greater extent showing wrinkled skins.

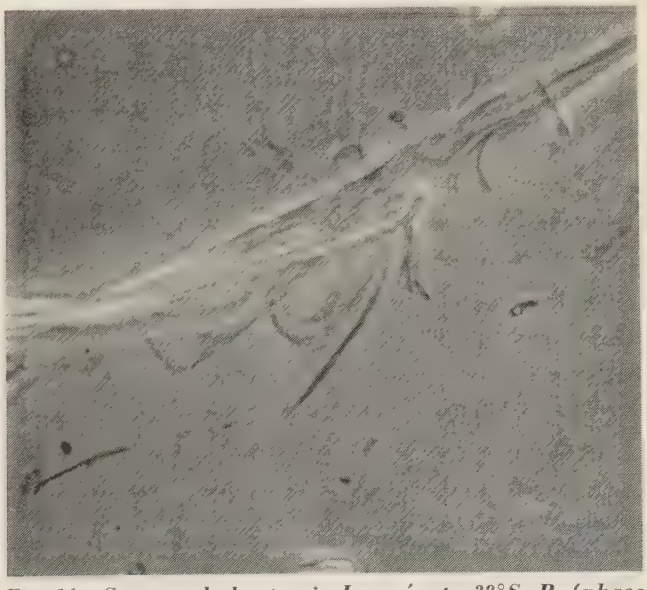

Fig. 16. Straw pulp beaten in Lampén to 38°S.-R. (phase contrast) (350×)

Figure 19 is a picture of Celdecor straw pulp after beating in the Turmix to 60°S.-R. This pulp shows the same fibrillation as the straw pulp which was cooked

by an alkaline process. There is only little internal fibrillation, but at the fiber end there is a very strong fibrillation in the form of skins which partly overlap and which are partly rolled up. The skins are not yet completely torn off from the cell wall and they still show lateral cohesion. Figure 20 shows a Lampén mill beating (36°S.-R.) of the same pulp as given in Fig. 19. Here a strong internal fibrillation at the fiber

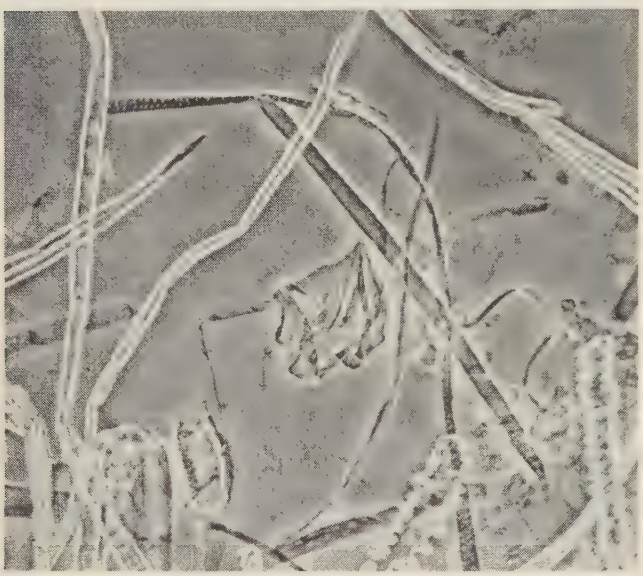

Fig. 17. Straw pulp beaten in Turmix to 54°S.-R. (phase contrast) (175×)

end is seen. Also observed are skins of cell wall material rolled up to apparently one-dimensional fibrils.

CONCLUSIONS

1. Phase contrast microscopy gives a unique oppor-

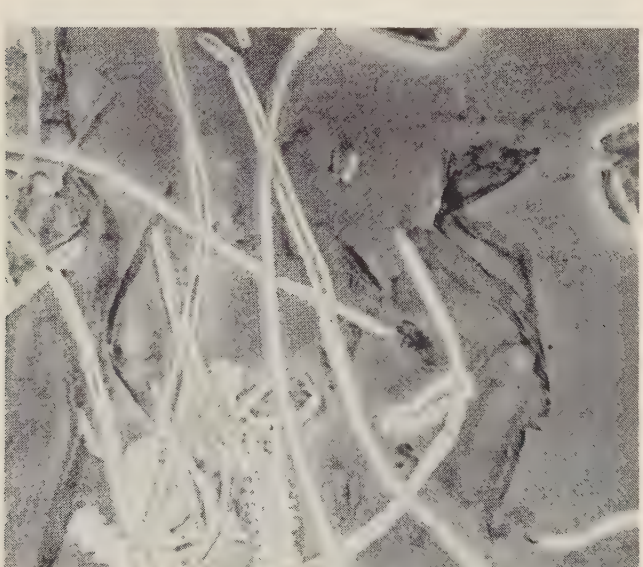

Fig. 18. Another part of the same sample as given in Fig. 17 (175×)

tunity of studying details of the structure of beaten fibers without any risk of artifacts; it is impossible to obtain the same results using the ordinary microscope or even with the aid of the electron microscope.

2. Beating of rag fibers in a laboratory Hollander or a Lampén mill yields only one-dimensional fibrils. The lateral cohesion of these fibrils, when still being

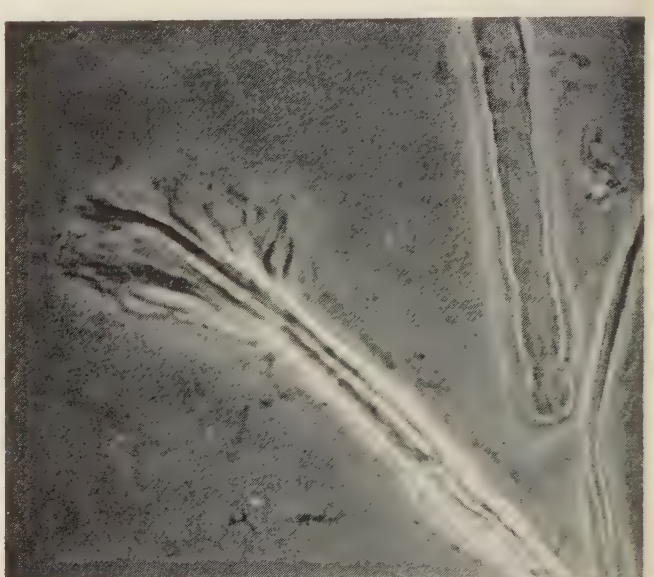

Fig. 19. Celdecor straw pulp beaten in Turmix to 60°S.-R. (350×)

present in the cell wall, is evidently not strong enough to withstand the distorting influence of the beaters. Usually the fibrils are still connected in the fiber wall

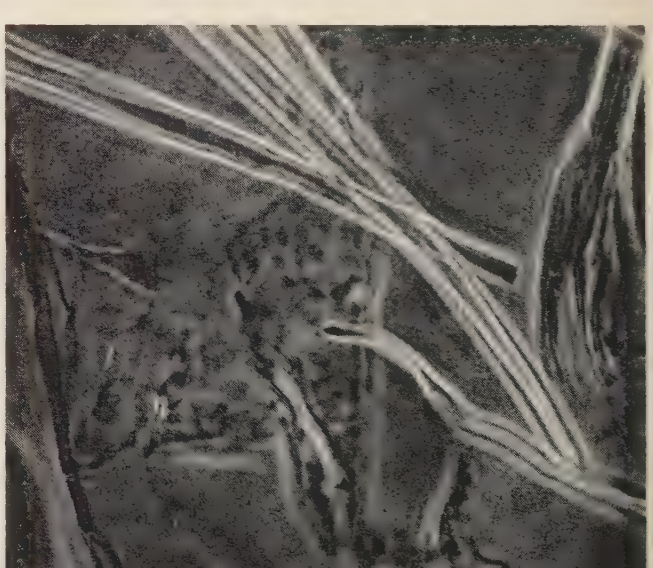

Fig. 20. Same pulp of Fig. 19 beaten in Lampén mill to 36°S.-R. (350×)

in one or more places and are only completely loosened by extremely strong beating.

3. When wood and straw pulps are beaten, principally skinlike pieces of cell wall material are torn off from the fibers. These skins have a fibrillar structure, but in contrast to rag fibers, they are still laterally connected in such a way that virtually no one-dimen-

sional fibrils are observed after beating. In the early stages of beating, the skins are still connected to the fiber wall, but on extreme beating they are completely torn off. The short fibrillike material, which is sometimes seen between the skins, proves to consist nearly always of rolled up, very thin skins.

4. Beating of straw pulp first attacks the parenchyma cells present in the pulp, yielding thin skins with a fibrillar structure. The straw pulp fibers themselves are only attacked by prolonged beating, and in this case skins are torn off from the cell walls as well. These skins are morphologically very much like those formed by beating wood pulp. In beaten straw pulp fibers fibrils just as is the case with wood pulp fibers are seldom observed.

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Application of a Differential Drive to Paper Machines

E. S. SKINNER

A new patented differential drive system developed by Beloit Iron Works gears all driven sections of a paper machine to a single line shaft located a short distance above the machine room floor. The line shaft passes through a series of differential units which make possible extremely sensitive control of draws between sections while maintaining without variation the fixed speed ratios thus established. Application of this new drive system to a variety of fourdrinier paper machines is stated to have reduced sheet breaks, raised sheet tests, and reduced shrinkage in the sheet width.

The differential drive represents a new approach to the problem of a paper machine drive. It might even be said that it becomes part of the machine itself so that a single prime mover, the turbine or motor in the lineshaft, is the only drive. It recognizes that all the equipment from the fourdrinier through the reel is part of the same machine and not a group of separate machines. In order to form and process the web of paper, each roll must rotate in perfect synchronism with all other rolls at all times.

The speed relation and resultant sheet tension between two adjacent rolls on a paper machine is commonly referred to as the draw. The author would like to suggest that the most nearly perfect draw on a conventional paper machine is between two adjacent driers that are properly mounted and driven by well-designed gears. In this ideal condition the rolls are of a fixed diameter and must rotate at a fixed angular velocity regardless of all outside influences. It makes no difference if one drier is partly filled with water, or whether a narrow tail or full width sheet is being handled. Being geared together, they must rotate together at all times.

Direct gearing then seems to be the simple answer to the problem of holding correct draws. It works between two driers for several reasons. First, there is very little change in the length of the sheet between driers; and secondly, the driers themselves are rolls which can be made to very accurate diameters, and they will hold these diameters over a long period of years. Even this method of controlling the speed of driers has its limitations, and so to relieve accumulated shrinkage about 20 driers are generally geared together and a controlled draw incorporated between each group. Thus, a long machine may have as many as five or six separate sections of driers.

E. S. Skinner, Assistant Chief Engineer, Beloit Iron Works, Beloit, Wis.

DRAW SITUATION AT THE COUCH

Let us now consider one of the most complicated draw situations; namely, the one between the couch and the first press in a conventional open machine. In forming the sheet, some of the fibers become entangled in the mesh of the wire so that a very definite tension is required to pull the web free. This tension can only be created by having the surface speed of the press rolls slightly higher than the speed of the wire. Experience has shown that the resultant stretch is injurious to the sheet, but it is one of those evils which must be accepted. The purpose then must be to control the speed of the wire and the press so that the amount of stretch will be at a very minimum.

Complicating the problem of holding a fixed speed ratio between the couch and the press is the fact that their power or torque requirements differ widely. The couch load is a high horsepower load due to the breaking effect of the flat boxes. Every change in formation, sheet weight, etc. is reflected sharply in the torque demand on the couch journal. Relatively, the torque demand on the press roll journal is much smaller and probably more steady. It does change, however, in the interval during which a narrow tail is increased to a full sheet in the press. This is an unfortunate change because it comes during the critical time of threading the sheet.

FIXED RATIO DRIVE

The differential drive was the first fixed ratio drive to meet these conditions successfully. The term "fixed ratio" has been purposely used to distinguish the differential drive from other types, for here is a drive that positively gears the couch roll to the press roll in a "fixed ratio" just as there was between the two adjacent driers which were previously discussed. Both rolls, being solidly geared together, hold the established

fixed speed ratio unaffected by any change in power requirements.

FIXED RATIO VERSUS REGULATED DRIVE

It is this concept of a fixed ratio which is believed to be a new approach to the problem of driving the rolls of a paper machine. It contrasts with most other types of drives which may be classified as "regulated" or "governor" controlled. In the regulated type of drive,

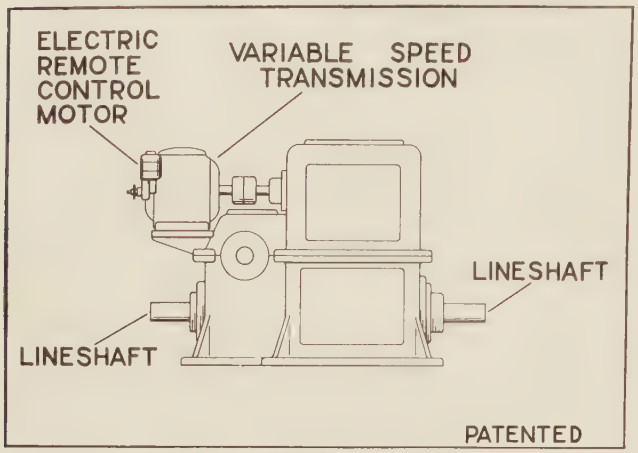

Fig. 1. Differential gear unit

a separate power source is installed at the inshaft of each driven roll as though it were an individual machine in a series of machines. A regulator of each of these power sources attempts to match its output speed to some kind of a speed reference.

The very nature of a regulating device limits it to action only after there has been a deviation from the speed reference, and, since it is a corrective device, it is inherently subject to cycling or hunting. It is true that regulators can be made to correct on very small deviations and that cycling or hunting can be dampened out, but the procedures required to do this are generally very complicated and difficult to maintain.

DESCRIPTION OF DRIVE

To achieve the fixed ratio between all sections of the machine, a lineshaft extends from the couch to the reel, a short distance above the machine floor level. A variable speed turbine or electric motor located near the center provides the power to drive the lineshaft at speeds proportional to the speed of the paper machine. All power take-offs to the individual sections are through the gears of the differential drive units. It is these units which permit the operator to make changes in infinitely small steps in the speed of the driven section. However, once the operator removes his finger from the draw control button, the speed of the section is positively geared to the lineshaft.

The drive unit, as developed and patented by Beloit, is based on the principle of transmitting the major portion of the power through one driven side of a differential. This is called the constant speed side because it is geared directly to the lineshaft in a fixed speed ratio. The other side is also driven from the lineshaft but in a ratio which may be changed by the operator. The connection to the lineshaft is through a variable speed transmission and reduction gears.

This variable speed side of the differential carries only the additional power to create the required draw in the section. For example, if the section load is 100 hp. and the unit is operating at 3% draw over the base speed, 97 hp. would be carried through the constant speed side and 3 hp. through the variable speed side. Since the variable speed transmission carries only the 3 hp., it can be selected with a very adequate service factor. On most of the units installed, Link-Belt P.I.V.'s have been used for the variable speed transmission. The P.I.V. has a 400% output speed range, and the connecting gear ratios are selected so that this entire speed range is used to increase the section speed only 6% over the base speed. The reduction of 400 to 6% illustrates the extreme sensitivity of draw adjustment available to the machine operator.

For a complete machine drive, a unit as shown in Fig. 1 is required for each driven roll. The heavy cast iron case keeps the gears in perfect alignment, protects them from dirt, and simplifies lubrication. A lineshaft driven pump in the base, combined with a gravity distribution system, assures oil to each bearing and gear over a wide speed range. In practice, the design speeds on a fine paper machine might be 50 to 600 f.p.m. and for a kraft paper machine, 250 to 2500 f.p.m.

The gears selected for the differential were based on experience with spiral bevel gears used in belt drives. Both the differential and the right-angle gears are of the spiral bevel type. All others are helical or straight spur type, as required by their operating speed.

The main shaft projecting on both sides of the case is in reality a section of the lineshaft. Through this shaft all sections of the machine are connected together and to the prime mover.

In this figure the output shaft is on the far side, projecting away from the viewer. In the upper left-hand

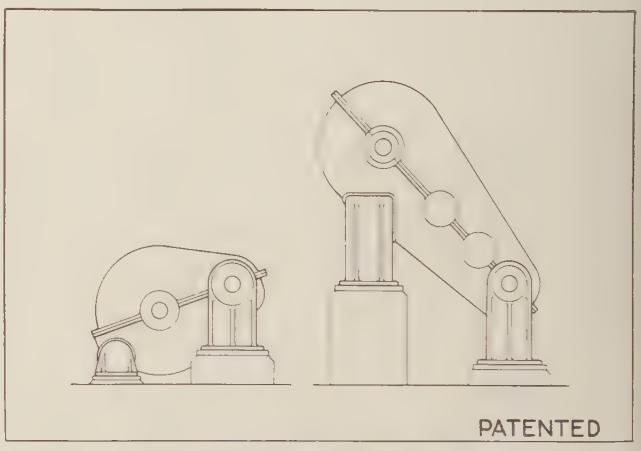

Fig. 2. Adjustable gear reducers

corner is the variable speed transmission. Mounted on a bracket integral with the case, it is easily available for inspection or service. Even complete replacement can be accomplished in a matter of minutes.

Mounted on the end of the transmission is the electric remote control motor. Equipped with a high reduction gear head and brake, it permits very accurate adjustment of the section speed. The control pushbutton is, of course, on the front side operator's panel, lo-

cated to give the machine tender a good view of the sheet run.

On drives for calenders and reels, a slack take-up is included with the remote control motor. Again operated from the front side panel, this device permits the calender or reel to be accelerated to take up slack in the sheet from the preceding section. As soon as the sheet is properly tight, the operator releases the control lever, and the previously established draw is automatically restored.

The output shaft of the differential unit is connected through an air-operated clutch to a special helical gear reducer, which in turn drives the machine inshaft. As has been emphasized, all rolls of the machine are rigidly geared together. There are no belts to slip or motors to stall in case of an unusually high power demand. Likewise, in starting a single section of the machine, the full torque or power of the prime mover is available. These two reasons led to the selection of the air-operated clutch whose torque capacity can easily be tailored to the requirements of each section. Exceptionally large clutches are used to give a high rate of heat dissipation, and the air pressure is regulated to provide smooth acceleration. When required, an air-operated brake is furnished, being controlled from the same operator's valve as the clutch.

Since the common lineshaft passes through all of the differential units, they must necessarily be mounted at the same elevation. This results in fixed elevations for the output shafts, which, in general, do not coincide with the rolls to be driven. The range in height may be considerable, say as much as 7 or 8 ft., between the bottom calender roll and the top roll of an inverted

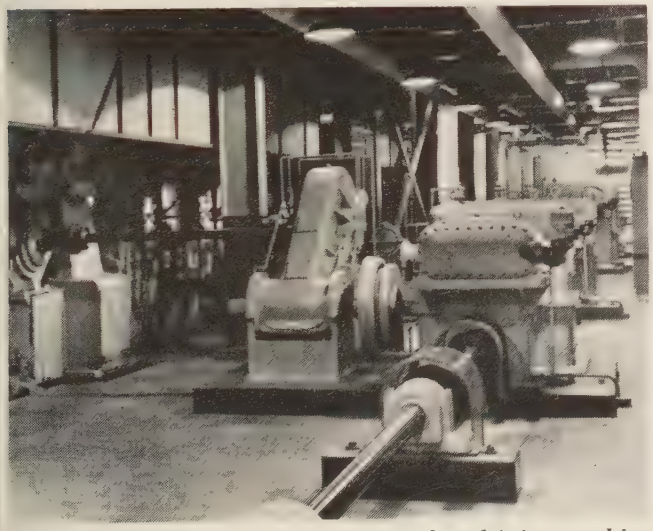

Fig. 3. Differential drive for 216-in. fourdrinier machine

press. And scattered between these extremes will be the several other rolls to be driven.

These differences in elevation are taken care of by mounting the helical gear reducers at suitable angles rather than in the conventional horizontal position. Standardized series of reducers were developed to cover a wide range of roll locations. Figure 2 shows two of these reducers. It will be noticed that they may be rotated about the input shaft by merely changing the supporting bracket. To assure satisfactory lubrication in any position and over a wide speed range, oil is supplied to each bearing and gear nip under pressure. Special nonrubbing oil seals were also developed which will operate in any position.

DRIVE APPLICATIONS

These various components, as assembled on an actual machine, are shown in Fig. 3. The unit in the fore-

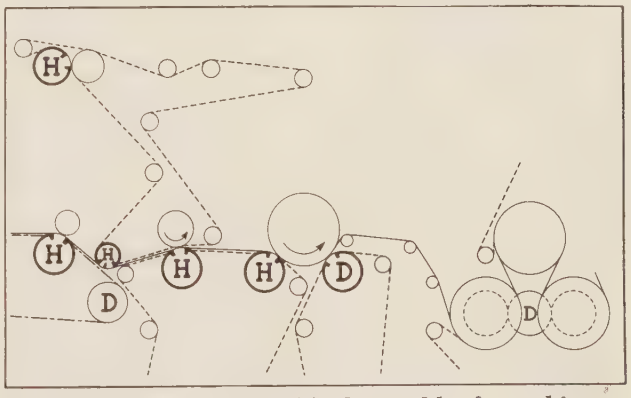

Fig. 4. Press section of high-speed kraft machine

ground is a smoothing press drive, and blending into the distance are the additional units for the driers, breaker stack, size press, calenders, and reel. Not included are the units for the couch and presses.

Some additional description of this installation might be in order, for it is a good example of a modern, open-type paper machine. Though primarily intended for food carton papers or boards, it is readily adaptable for a wide range of other sheets. The machine includes the following sections, each being driven by its own differential drive unit: (1) 216-ft. by 130-ft. wire fourdrinier with 42-in. diameter suction couch; (2) first conventional suction press; (3) second inverted, air bleed, suction press; (4) pre-drier section; (5) third plain hot press; (6) smoothing press; (7) second drier section; (8) breaker stack; (9) third drier section; (10) size press; (11) fourth drier section; (12) first calender; (13) second calender; and (14) reel.

Because of the long fourdrinier wire and the many flat boxes used on heavy sheets, the couch requires approximately twice the horsepower of any other section. Therefore, with the differential unit an electric helper motor was used to supply a portion of the required torque. The differential carries approximately half the load and controls the speed of the wire. This arrangement made it possible to use only two sizes of differential units for all 14 sections.

The same lineshaft-driven generator that powers the couch helper also provides a variable voltage for motors on a return wire roll and the lumpbreaker roll. The main lineshaft drive is a 1600-hp. geared turbine which helps to create a favorable steam balance. The whole drive is capable of operating at machine speeds of 150 to 1500 f.p.m.; and with minor changes, the top speed can be increased.

Thus far we have been concerned with the conventional fourdrinier machine having a number of open draws. Here the exact speed ratio between sections is

a distinct advantage. There are, however, many machines using felts to carry the sheet between sections. In these situations the differential drive is not necessary, since the relatively high strength of the felt is sufficient to control the speed of adjacent sections.

For example, a simple Yankee machine, electrically driven, requires only one accurate speed control on the drier motor for making creped sheets. The entire wet end is tied together by the pick-up felt, and the sheet off the drier has considerable elasticity. Since accurate speed controls are not required on the press motors, the installation will be less expensive and simple to operate.

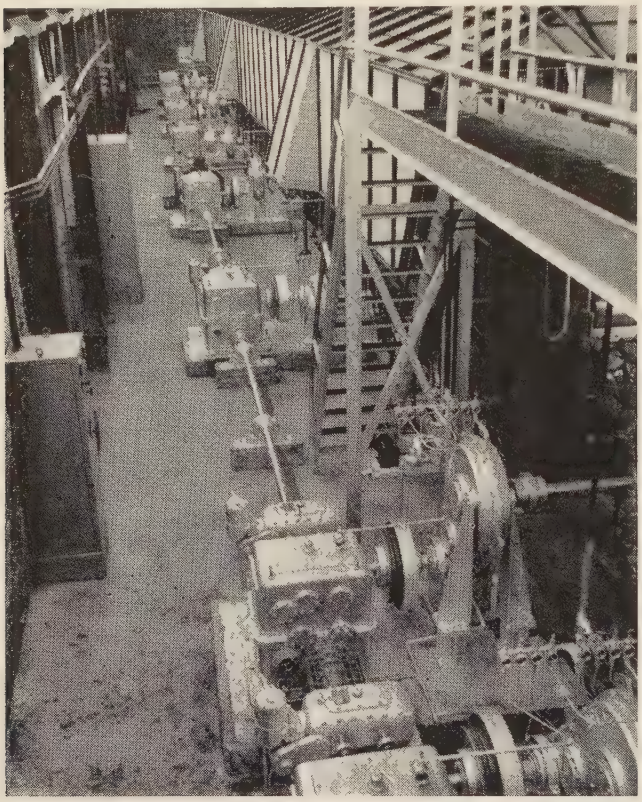

Fig. 5. Differential drive for 130-in. fourdrinier machine

There have been many recent improvements in wet end arrangements designed to eliminate sheet breaks. In addition to adapting easily to these new press sections, the differential drive is an ideal supplement that assures safe passage for the sheet through the balance of the machine.

On machines having both open draws and a pick-up felt, the differential drive, combined with electric helper drives, gives the advantages of both. Figure 4 diagrams the application of a drive of this type applied to the wet end of a high-speed kraft machine. In this drawing a D has been placed in the circle for each roll driven by a differential unit and an H to indicate those rolls driven by helper motors.

Note that the speed controlling differential drive is on the turning roll of the fourdrinier wire. The suction couch has a helper-type drive since its speed is regulated by the wire. Likewise, the speed of the pick-up felt and the bottom felt is set by the differential press drive in an exact ratio to the wire. This is necessary since the light contact between felt and wire would easily scuff the sheet. Differentials on the drier part and the balance of the machine hold the exact draw required to peel the sheet from the center roll of the cloverleaf press.

Another interesting application was made on a machine making a corrugating sheet at high speed from semichemically cooked stock. Such a sheet has very little wet strength and is quite heavy in weight. Thus, it can be appreciated that breaks between the couch and driers were frequent at 1400 f.p.m. paper speed.

Since the drive on this machine was relatively new and in good physical condition, it was decided to install differential units on the couch, two suction presses, and the first drier section. The hypoid drive on the balance of the machine was retained. This resulted in the fixed ratio control between the high horsepower couch drive, the low inertia press drives, and the high inertia drier section. So successful was the reduction in wet end sheet breaks that additional similar installations are now being planned.

MILL EXPERIENCE WITH DRIVE

Ease of operation has been a feature of the differential drive. Convenient controls for inching, running, braking, and slack take-up are included in the front side operator's panels. Also available is a simple torque indicating device which continuously shows the torque carried on each unit.

The Beloit differential drive has worked out well in actual use, both on a machine for producing high quality rag content papers and on a number of wider and faster machines. The chief advantage noted by operators has been the holding of draws without variation. Sheet breaks have been sharply reduced, especially those which would normally be expected at the wet end of a paper machine. Sheet tests have been raised since draws can be held which place an absolute minimum of strain on the sheet. In fact, former standards for draws between sections do not apply to machines with the differential drive. As information comes in from the mills, a new set of standards which specify greatly reduced draws are gradually being developed.

A related advantage is that there is less shrinkage in the width of the finished sheet. For example, one mill with an existing 100-in. machine was experiencing approximately 7-in. shrinkage in sheet width. Their new 130-in. machine with a differential drive shows only about 5-in. shrink for the greater width.

Figure 5 shows a complete drive installation. From the point of view of mill planning and construction, the differential drive brings the entire system to the machine room floor. The basement area is freed for other purposes. When a turbine is used for a prime mover, exhaust or extracted steam is efficiently used in the drier section.

Finally, the Beloit differential drive can be maintained properly by present mill staffs since this mechanical system is composed of gears, bearings, and shafting used in other machinery. There are no belts to maintain, and no specially trained service personnel are necessary.

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A Pulpwood Flume System

JOHN R. FIELDING

A description of the pulpwood flume system installed at Union Bag & Paper Corp.'s Savannah mill, designed for an average capacity of 200 cords per hr., is presented. New developments for this installation include gantry cranes for unloading rack cars into the flume; truck dumping arrangement; rotary pulpwood distribution table supplying wood to six barking drums; sand, grit, and bark removal equipment, and the application of plows for regulating log feed from the table and drag chain conveyor discharging to individual barking drums.

THE flume system at Union Bag & Paper Corp.'s Savannah mill was developed for the particular requirements of the mill to furnish a nominal productive rate of 1985 tons per day, 1585 from pine and 400 from hardwood semichemical pulp.

Initial studies showed that to provide for dual wood use, basic facilities must provide the following: (1) live storage for pine pulpwood of 52,000 cords, (2) live storage of hardwood of 16,000 cords, (3) railroad car unloading for a 200 car per day rate, (4) means to supply the woodroom at the rate of 200 cords per hr., when operating on pine. (5) a method of feeding pine to two sets of existing barking drums and one new set of drums, (6) interconnection of the system for the new woodroom to handle both pine and hardwood, (7) storage of chips as reserve supply when chipping hardwood on an 8-hr. basis, and (8) continued operation of the existing woodyard throughout the new construction period.

To meet these basic requirements, it became apparent that a new woodyard for pine, using a flume system, and converting the existing woodyard to hardwood offered the most feasible solution.

FLUME

Investigation of existing flumes indicated the new flume should be designed with a hydraulic gradient for a minimum flume velocity of 5 ft. per sec. Based on the outlined pine storage, and allowing for possible future extension of the flume, the basic design is a 4400-ft. flume. For the initial installation, a 3200-ft. length of flume was installed. The hydraulic gradient established took into account the desirable flume cross section, water velocity, and the friction factor applicable for logs rubbing against the flume sides. Calculations indicated a drop of approximately 7 ft. in the maximum flume length would produce the desired velocity. An additional drop of 3 in. was taken at the corners for a total gradient of 7.82 ft. from the water inlet to the foot of the escalator conveyor. Beyond the escalator conveyor an additional invert drop of 6 in. is taken through the approach channels and settling basin which is described in more detail under "water clarification" later on. Due to the shorter length of flume originally installed, approximately 2 ft. of the drop is taken across the temporary south leg.

A typical cross section through the flume along the loading areas has a width at the bottom of 3 ft. with sides inclined to 9 ft., 7 in. at the top of the concrete. Above the concrete, loading aprons slope upward at a 30° angle to the railroad, top of rail being approximately 9 ft. above the flume invert. The sides of the flume are lined with steel plate extending 18 in. above and below the normal water depth of 3 ft., 6 in.

The flume corners have been held to a 75-ft. radius. At the corners and straight runs where no unloading facilities are available, the flume section changes from sloped to straight sides.

Loading aprons 1000 ft. in length extend along the east and west legs of the flume. On the west leg the aprons rest on undisturbed soil, for which reason concrete was used. Experimental sections 100 ft. long have been set up using heavily reinforced concrete slab 12 in. deep; plain concrete slab 12 in. deep with embedded railroad iron; 12-in. plain concrete slab with $^1/_2$-in. steel plate cover, and 12-in. plain concrete slabs with catface mats. Along the east leg, which due to yard elevation had to be built on fill, the loading aprons were built of pine catface mats bolted together in 6-ft. sections, placed over 6 in. of crushed stone. After the mats have reached their final settlement, concrete aprons can then be poured. Along the south flume leg a concrete section of apron has been poured to receive logs from a pulpwood truck unloader.

As noted, the hydraulic gradient for the 4400-ft. length of flume was designed to produce a velocity of 5 ft. per sec. In actual operation on the 3200-ft. flume, velocity is about 7 ft. per sec. at 45,000 g.p.m. Some of the increased velocity is due to the shorter flume length but the friction factor assumed for logs scraping against the steel liner plate, particularly at the flume corners, is also partially responsible. The logs do not come in contact with the sides around the corners due to a counter-undercurrent set up by the water as it approaches the curve, thus rolling the wood toward the center line of flume.

Under present installation, the flume velocity is sufficient to handle more than the 200 cords per hr. rate.

WATER USAGE AND CLARIFICATION

Water for use in the flume is taken from the seal pit on the evaporators. Twenty-five hundred gallons per minute are used constantly to provide water for the sprays on bark removal screens, high-pressure nozzles, and make-up to the flume.

To insure continued flume operation, a settling chamber to slow down the water velocity to 1 ft. per sec., thus allowing grit, sand, and sand-impregnated bark to drop out of suspension, was incorporated into the flume design. Water flows through the chains on

JOHN R. FIELDING, Chief Construction Engineer, Union Bag & Paper Corp., Savannah, Ga.

Fig. 1. View showing flume empty

Fig. 3. Pulpwood truck unloader

the escalator conveyor to three separate approach channels ahead of the settling basin. Water velocity in each channel is designed for 3 ft. per sec. to prevent presettling. Three settling chambers are each equipped with drag buckets mounted on chains to remove the settled materials and a bark screen to remove loose bark. It was found that conventional vertical screens will not handle the quantity of bark coming off in the flume when reclaiming pulpwood which has been in storage from 4 to 5 months. The screens as now installed are inclined at an angle of 18° which allows for one unit to be down even when handling old wood.

Bark is removed from the screens by sprays at 60 p.s.i. to a water sluice discharging into the bark conveying system under the barking drums.

Grit collection equipment is essential to continued flume operation. Grit is composed of small stones, loose sand, and sand-impregnated bark from which none of the pulpwood is free. Even on green wood unloaded from cars directly into the flume, there is sufficient sand and heavy bark to shut the flume down in a short time if the grit collection equipment is not operating. As sand deposits in the settling chambers, the hydraulic gradient in the flume is changed, thus altering water velocity. Grit is discharged from each chamber into a chain conveyor which dumps into a load-lugger bucket. Average collection is approximately 4 cu. yd. per hr. although double this rate has been experienced when cleaning up old log piles.

Settled water passes through the bark screens into the pump sump chamber to a 45,000-g.p.m. 14-ft. total dynamic head pump driven by a 200-hp., 400 r.p.m. motor. The pump discharges through an underground concrete pipe up to the high end of the flume.

WOOD HANDLING

Pulpwood cars are spotted along both sides of the unloading sections paralleling the flume. Forty-four rack cars can be placed along each leg, 22 in one switch. The unloading track is a three-rail line, the inner rail being for a gantry crane spanning the flume. When unloading box cars, the gantry crane is run to the end of the track and cars are placed on the two rails next to the flume.

The gantry cranes pull the wood off the car directly into the flume. Gantry unloading rate is approxi-

Fig. 2. Flume in operation with gantry unloading crane

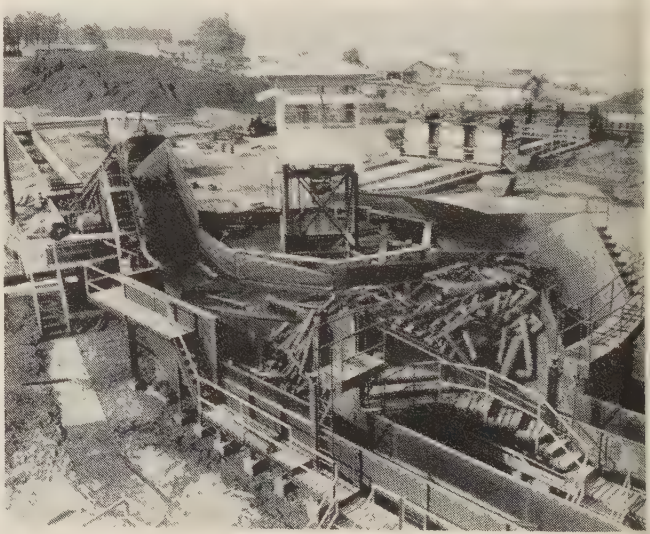

Fig. 4. View of distribution table, escalator, and settling basin

mately 6 min. per rack car, being regulated by barking drum requirements. Pulpwood from yard storage is handled by conventional cranes operated in conjunction with the fresh wood from the rail cars. Truck wood is dumped into the flume as received. Trucks back onto a hydraulic lift platform, hinged at the flume end. Trucks are inclined until the pulpwood starts to roll off into the flume. Wood supply at present approximately balances at 200 cords of truckwood, 700 from storage, 2100 from cars, for a total of 3000 cords per day.

Wood is removed from the flume on a five-strand chain conveyor inclined at 22°. Logs discharge over the head pulley onto a 43-ft. diameter rotary table. Remotely controlled hydraulic plows distribute logs into any one of three conveyors. By adjustment of the plow setting, all three conveyors can be fed at once if desired. When more pulpwood is discharged onto the table than the barking drums can use, the hydraulic plows are pulled back and excess wood passes the conveyors to a fixed plow discharging into the flume for recirculation.

Wood from the three drag conveyors discharges to individual inclined conveyors, feeding three sets of two barking drums per set. In addition wood from the old storage yard, which is for hardwood storage under the new arrangement, can be fed to the drum conveyors. This provides that during flume emergencies, rack cars of pine can be located along the old conveyors to keep a supply of pine to the drums. Also, hardwood is furnished to the new drum conveyor from the old yard during the 8-hr. chipping operation on hardwood.

To allow for the intermittent chipping of hardwood, chip storage silos are an essential part of the system. Two units, 40 ft. in diameter, 60,000 cu. ft. capacity each, furnish the surge storage.

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Safety Evaluation and Protection of Digesters

H. M. CANAVAN and W. B. PARKER

The procedure to be followed in making a complete inspection of a digester is discussed. The visual examination of the digester and its appurtenances, methods of determining the thickness of the shell and heads, and the proper recording of the information developed on TAPPI Data Sheets are described. The interpretation of the results to obtain the location of critical areas, the safety status of the digester, whether repairs are required, and an estimate of the remaining service life are included. Overpressure safety systems for digester protection are also covered.

The amount of potentially destructive energy stored in a pulp digester constitutes a hazard that demands respect. With the possible exception of the boilers, the explosion of a digester is the most serious explosion hazard involved in the operation of a pulp or paper mill from the standpoint of loss of life and widespread physical damage.

Corrosion and erosion of digesters are ever-present problems in all paper mills and the insurance companies are indeed glad to see this problem receiving the attention it has been given recently in an attempt to determine and correct the causes of the corrosion and erosion.

The highly corrosive nature of the cooking liquors used in sulphite processes makes special materials a necessity, usually requiring nonmetallic linings which present special problems in inspection, maintenance, and safety protection of the digesters.

In sulphate digesters nonmetallic linings are not commonly used, the metal being exposed to the cooking liquors. The wear in this type digester may be the result of a corrosive action of the cooking liquors, corrosion or erosion resulting from loading practices, and erosion from the movement of the material being cooked. Changes in the cooking process combined with using woods today that were not used formerly are believed to be at least contributing factors in the greatly increasing corrosion problems. Undoubtedly great progress can be made by a careful study of the cooking processes which should indicate reasons for many of the corrosion problems that have developed recently.

No attempt will be made in this paper to discuss the chemistry of pulp making or action that may be taken in connection with the cooking processes to prevent corrosion or erosion. The discussion will be confined to the actual inspection, safety evaluation, and protection of digesters in service, mainly from the standpoint of the insurance inspector.

The principal steps in determining the safety of a digester are: visual inspection, determination of remaining thicknesses, and interpretation of results.

VISUAL INSPECTION OF SULPHATE DIGESTERS

The visual examination of the digester and its appurtenances is a very essential part of any investigation as it is the basis of all other study. Only by a thorough visual examination may proper areas for further study be selected, whether that study consists of thickness readings, location of plate or weld samples, or the examination of a defective forge weld.

Permanent and detailed records of the corrosion and scale patterns, the nature and effect of the scale, and the influence of fittings, chip, and liquor impingement must be taken periodically so that changes in the corrosion and scale pattern may be quickly determined. A record is also of value in the interpretation of thickness measurements, which do not tell the complete story in themselves as the areas of active corrosion may shift between inspections.

The complete information so collected will permit a thorough study of conditions developing within the digester at any time. Information developed at a

H. M. Canavan, Chief Inspector, Boiler Div., Mutual Boiler & Machinery Insurance Co., Boston, Mass., and W. B. Parker, Asst. Chief Engineer, Boiler Div., The Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

number of inspections on a single digester with other data that may be developed regarding changes in operating procedures, etc., would permit a complete study of the probable effect of the various changes in the corrosion or scale pattern and the extent of the change that developed between inspections.

At this point it should be emphasized that the compiling and maintaining of complete inspection reports and records is the responsibility of the plant personnel and not of the insurance inspector. The insurance company inspection and reporting procedures are not set up to handle this type of service, and the maintenance of complete records would not be possible because of changes in inspection personnel, the length of time between inspections, and the fact that certain information on operating procedures is not readily available to the inspector. The main function of the insurance inspector is to determine the safety of the digester for continued service. There should be, however, full cooperation and exchange of all information between the plant inspection staff and the insurance inspector to insure better all-around inspection service.

PREPARATION FOR THE INSPECTION

For an inspector to do an entirely satisfactory job of inspecting the internal surfaces of a digester, he must make the inspection under conditions that are conducive to performing the best work. It is necessary that the vessel be properly prepared for the inspection, cool enough so that the inspector will not feel rushed in his work, and the internal surfaces accessible for a close and thorough examination.

Two types of platforms have been designed and at present are used by different mills, which can be moved up or down at will and provide a satisfactory working platform for inspection, repairs, and the taking of thickness measurements. It is suggested that all mills adopt the use of a movable platform as a time saver in the inspection and repair of digesters.

In addition to a suitable working platform, it is necessary that adequate lighting and ventilation be provided.

For ready reference digesters should be laid out in some definite pattern and reference to internal conditions should refer to this pattern. One method of lay-out that has proved very satisfactory is to mark the digester off into eight equal parts around the circumference of the digester. At each of these eight points, and at a set distance below the top girth weld a stainless steel stud is welded to the side wall and each stud numbered or lettered. From these studs, chains with washers spaced on 2-ft. centers are hung. With the eight equal distance markings around the circumference of the vessel and the chains marked off in 2-ft. sections, an effective grid pattern is established for ready reference during the visual examination of the digester and for ready spacing of the thickness determination readings.

A separate copy of the TAPPI Data Sheet should be used for each digester examined. The data sheet must be completed in detail so that a complete record of the inspection, the date the inspection was made, and other pertinent information will be accurate.

In reporting upon the observed condition of the surfaces, the corrosion code given on the top of the data sheet, should be used. It may be desirable to devise additional symbols for recording other types of surface and scale conditions not included in the code. In many cases written notes are also helpful as a supplement. In any case, it is important that a complete description be given of the surfaces so that at the time of the next inspection the data sheets may be compared to determine if there are any changes in the pattern of corrosion or scale build-up between inspections.

INSPECTION OF NEW DIGESTERS

New digesters should be carefully examined and a data sheet completed before they go into service so that a complete record of the condition of the shell and head surfaces will be available for comparison with corrosion and scale patterns at a later date. On this first data sheet it will be necessary to make written notes describing the condition of the surfaces as the corrosion code at the top of the data sheet will not apply to new digesters that have not seen any service.

Good quality steel plate normally has a smooth, even surface which is covered with a dark gray or black, iron oxide scale commonly called "mill scale." This scale may become partially dislodged or even completely removed during fabrication. However, a record should be made of the extent of this scale coverage over the surfaces since the scale may inhibit corrosion in some cases, or possibly, because of electrolytic action, cause corrosion in areas not covered by the scale.

Any pits or depressions which lie in a straight line or over a generally affected area should be indicated.

A search of the surfaces should be made for any defects which may be the result of steel manufacture. Scabs, slivers, or laminations may be recognized by the fact that the original mill scale may be present under the raised edges of the areas. The size and location of such defects should be accurately reported on the data sheet.

Any evidence of a repair, either by welding or by chipping and grinding, should be recorded for future reference in the event accelerated corrosion in the repaired area develops in the future. Any other imperfections in the plate should be accurately recorded on the data sheet for future reference.

All openings from the digester should be carefully examined to determine whether or not there are any defects such as cracks, undercutting, etc., in the areas of the openings.

All welded seams should be carefully examined to determine whether or not there are any visible defects in them, such as porosity, undercutting, evidence of burning, slag, etc., which should be recorded for future reference. Any serious defects in the vicinity of the welded seams should be discussed with the insurance inspector and, if necessary, with the manufacturer for proper correction before the vessel goes into service.

If the original weld surfaces have not been removed by chipping and grinding then the type of welding applied, particularly to the internal surfaces should be recorded on the data sheet. Welds will normally be recognizable as either manual arc or automatic. Manual arc welds are normally indicated by closely spaced ripples, while automatic welding results in ripples that are somewhat chevron-shaped.

Lined or clad digesters should be carefully examined

especially at the seams, to determine that no defects are in existence before the digester is placed in service. Any questionable areas should be described fully on the data sheet for future reference.

INSPECTION OF DIGESTERS THAT HAVE BEEN IN SERVICE

All the internal surfaces of the digester should be carefully examined, preferably starting at the bottom head or cone, completing a copy of the TAPPI Data Sheet, indicating any defects, corrosion, washed or scaled areas as the close scrutiny of the surfaces progresses.

All welds should be carefully examined for any type of defects including grooving along the sides of the welds, accelerated corrosion in the heat-affected zone near the edge of the welds, wastage of the weld metal, and cracks or other defects in the weld metal. Special attention should be given to the edges of forge welds and any cracks or other defects should be indicated on the data sheet and further investigated to determine the extent of the defect and its effect upon the safety of the object.

Any areas that have been previously repaired by building up with weld material, or areas that have been protected by a weld overlay of corrosion-resistant metals, should be carefully examined and fully reported upon as to the existing condition at the time of each examination.

The nature of any corrosion observed on the internal surfaces should be carefully described as to whether it is in the form of pitting, general corrosion, or grooving. The type of corrosion should be indicated on the data sheet using a proper symbol. Indicate whether pitting is shallow or deep and whether it is scattered or relatively close in nature. Generally corroded areas should be shown indicating whether the corrosion is light or heavy and whether it is scattered or in the form of general wasting away, leaving bright exposed metal. Additional comments should be added as to whether or not the original mill scale is left on the uncorroded portion of the surface.

Bright areas and depressions, particularly in the form of vertical grooves under blanked off or existing fittings should be described and marked for further investigation by drilling, with the Audigage, Gammagage, or other thickness-measuring devices.

When there are great differences in thicknesses between inspection points additional readings should be taken to determine whether the thin areas correspond with depressions which can be observed visually. It should be borne in mind that the regularly spaced inspection points for investigation by the Audigage or Gammagage are for the purposes of analysis of the general condition of the vessel and are not considered as representative of the thickness of any specific areas. If any depressions or other apparent defects are found by visual examination, these areas should be marked for further examination to determine the more seriously affected area.

Scale should be examined very closely to determine its boundaries, color, thickness, toughness, and continuity. The original mill scale can be easily distinguished from scale deposited as a result of operations and should be so indicated upon the data sheet. Scaled areas should be marked carefully on the data sheet so that a study may be made to determine any change in the scale pattern. It has been found that the scale pattern is influenced greatly by operating procedures and in many cases, operating procedures have been changed after a study of the scale pattern and corrosion reduced or eliminated by depositing a protective coating of scale over the digester surface. Where the thickness of the scale varies greatly in the various portions of the digester, that information should be recorded on the data sheet for future reference.

If the inspector also makes the thickness determinations, the complete examination may be made in one inspection of the surfaces of the digester. If the inspector merely makes the visual examination, marking certain areas to be examined more closely by means of other inspection methods, these areas should be clearly indicated as to the type and extent of the further examination to be completed. Areas on which additional thickness readings are desired should be indicated with specific information for the guidance of the operator as to the number of readings required.

The above comments apply particularly to welded sulphate digesters. The same comments will apply to riveted sulphate digesters, however, special care should be given to the examination of the riveted seams on the internal side of the digester to determine whether or not there is any accelerated corrosion effect at the seams. The external surfaces of the digester in the vicinity of the seams should also be examined to determine if there is any indication of leakage at any of the riveted joints.

External surfaces of welded digesters should also be examined for serious defects at the seams which would probably manifest themselves by indications of leakage through the insulation. This comment applies particularly to forge-welded digesters.

A careful examination should be made in the vicinity of all openings, nozzles, thermometer wells, etc., to determine whether or not there is any defect in the attachments themselves or in the weld metal.

VISUAL INSPECTION OF BRICK-LINED DIGESTERS

The problems in connection with brick-lined digesters are greatly different than with unlined or those lined with corrosion-resistant metals.

In preparing a brick-lined digester for inspection, it is necessary that the digester be cooled slowly to prevent damage to the lining. The platforms previously mentioned may also be used for the inspection of this type of digester and, in fact, the use of platforms is recommended so that a careful examination may be made of the lining at all levels. The platform may also be used for repairs.

As the internal metal surfaces of the digester are not accessible for examination, it is necessary that the brick lining be carefully examined to determine whether or not there is any spalling of bricks, loose bricks, or loose sections that may allow the cooking liquor to reach the metal surfaces. In sulphite digesters it is of utmost importance that the lining be maintained properly as cooking liquor in contact with the metal surfaces causes rapid and serious corrosion. Any defects of this type should be carefully examined to determine the extent of the defects and marked for necessary repair. Any bulges in the brick lining should be carefully examined

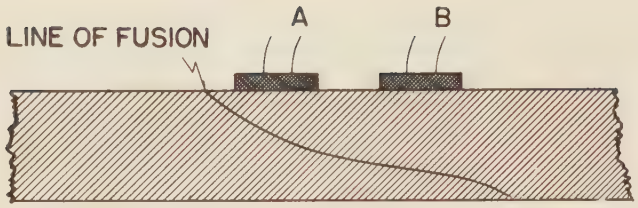

Fig. 1

and proper steps taken to remove the damaged bricks and to make proper repairs.

Periodic thickness determinations are not feasible as a complete safety precaution on brick-lined digesters because of the rapid corrosive attack normally expected in the event of a lining failure. This type digester should be provided with tell-tale holes on approximately 2-ft. centers which will, in most cases, indicate, the existence of serious corrosion before it reaches a stage that may result in a violent explosion of the digester.

DETERMINATION OF THICKNESS

For the safety evaluation of a digester to be of any importance, it is necessary that the thickness of the shell and heads of the digester be accurately determined at regular intervals. Usually thickness determinations made annually are satisfactory. However, in many instances it is desirable that thickness determinations be made at more frequent intervals particularly when serious corrosion or erosion is in evidence or when the vessel is approaching the end of its service life.

A method of providing a permanent grid for ready reference in making the visual examination of the digester has been previously described. This grid will also serve as a guide in locating points for thickness determinations. By determining the thickness of the shell or head at the same points at each inspection after a period of time a series of readings will be accumulated from which the corrosion rate and estimated service life may be obtained. Areas that have been marked for more complete investigation at the time of the visual inspection will require additional thickness readings. The best method of obtaining readings that may be checked in the future is to develop a smaller grid pattern that may be definitely outlined on the data sheet.

Several nondestructive thickness gages have been developed using ultrasonic resonance, gamma ray, and magnetic effects that have been successfully used in determining the thickness of shells, heads, linings, and cladding. Thickness determination may be made quickly and easily with these instruments, cutting inspection time considerably over older methods.

The Audigage, manufactured by Branson Instruments, Inc., Stamford, Conn., is probably the most widely used instrument in the United States, while the Gammagage, manufactured by Isotope Products, Inc., Oakville, Ont., is more popular in Canadian plants. It is suggested that all plants that do not as yet have a thickness measuring instrument obtain literature and consider one of the above-mentioned gages or one of the other acceptable instruments.

If a thickness determining instrument is not available it will be necessary that thickness of the shell and heads be determined by drilling and measuring with a hook gage at intervals required by the inspector.

For those plants operating forge-welded digesters, experience indicates that the Audigage has another very important use. The Audigage will not indicate thickness through a void or lamination in the plate as the void stops the vibrations and only the thickness to the void is indicated, or no reading is obtained if the void is at an angle so that the vibrations are not reflected by the crystal.

The usual outline of a forge-welded seam is shown in Fig. 1.

Defects in forge-welded seams are usually the result of lack of fusion. This type of defect may be located at any point along the line of fusion shown in Fig. 1. Defects at the edge of the scarf will be found at the time of the visual inspection and should be further investigated to determine the seriousness of the defect. If the defect is located other than at the edge of the seam, it cannot be detected at the time of the visual inspection. Defects of consequence can, however, be located with the Audigage.

To determine the condition of a forge-welded seam, Audigage readings should be taken at alternate 4-in. intervals along both sides of the center line of the weld. Full thickness readings indicate that the welds are sound. A partial thickness reading or no reading will indicate a defective weld. Referring to Fig. 1, assuming the seam is defective, no reading would be obtained with the Audigage crystal in position "A" because of the angle of the void. In position "B" a partial thickness reading only would be obtained. When a defective area is located very close readings should be taken, actually overlapping the readings, to determine the extent of the defect. Complete information should be entered on the data sheet for further study and consideration as to whether repairs are necessary or feasible.

INTERPRETATION OF RESULTS

The interpretation of the data accumulated as the result of an inspection of a digester is a very important phase of the inspector's work.

When complete information has been accumulated on a digester, including the necessary data on the vessel itself, the TAPPI Data Sheet completed at the time of the visual inspection, all thickness determinations and additional information developed regarding any changes that may have been made in the operating procedure, a careful analysis should be made to determine whether or not any action in connection with the digester is necessary before it is returned to service. This analysis should include a review of the past history of the digester and any previous data sheets covering visual inspections and thickness determinations.

The review may indicate that a special study should be given to the operating procedures that may have resulted in the development of scale deposits, corrosion, erosion, or pitting over the surfaces. This would be especially true if any change in the areas previously affected were noted, that would indicate a shifting of the scaling or corrosion from one portion of the digester to another.

An evaluation of the complete data may be designed to yield at least four different types of information: (1) physical and chemical causes of corrosion, (2) location of critical areas, (3) safety status of the digester, and (4) estimate of remaining service life.

PHYSICAL AND CHEMICAL CAUSES OF CORROSION

A study of the complete data on the digester should be made to determine if the method of loading has resulted in corrosion or erosion from one or more of the following causes: (1) chip impingement, (2) liquor impingement, (3) liquor splashing on hot metal surfaces and (4) methods of loading that may result in unusual packing of chips in certain portions of the digester, causing liquor channeling during the cooking period.

When corrosion has developed between inspections to an unusual extent, changes in the cooking procedure should be carefully investigated to determine, if possible whether such changes may be the reason for the increase in the corrosion rate. Any chemical change that has been made since the last inspection should be carefully investigated. Changes in cooking temperature or any change made in the liquor concentration or changes that might affect the liquor circulation should be given consideration.

Based on the complete information developed on the digester, it is probable that the inspector will be in a position to discover what changes have effected any deviation in the established corrosion rate, and by discussing certain indications, determined by the inspection procedure, with the operators, may disclose information that will make it possible to check serious corrosion of the digester.

LOCATION OF CRITICAL AREAS

With properly completed data sheets covering the visual inspection and the determination of thicknesses, the location of any critical areas in the digester should be an easy task.

The most critical area will normally be that of minimum thickness and maximum corrosion. However, it is possible that the most critical area noted at the time of any inspection may not be the area that has at the time of past inspections, been most seriously affected by corrosion. A corrosive condition may have been corrected by a change in the process or loading methods, so that the seriously corroded area previously noted, has shown no progress while another area in the digester, that has developed since the last inspection, may be seriously affected.

For that reason it is of utmost importance that the change in the thickness of the digester be specifically noted in all areas from one inspection to the other and these areas should be noted for careful study to determine, if possible, the reason for the change in the corrosion pattern before the digester is seriously affected.

Assuming that the minimum safe operating thickness of the digester has been previously determined, it is merely a matter of examining the thickness determination readings to discover whether or not any area in the digester has reached a stage where repairs or a reduction in pressure may be necessary.

SAFETY STATUS OF THE DIGESTER

When determining the safety status of the digester, it is necessary that complete detailed information on the area of the digester under consideration be available. Additional thickness measurements in this area may be necessary to determine the extent of the affected zone.

When considering the effect of any area upon the safety status of the digester, it is necessary that consideration be given to: (1) remaining thickness of metal, (2) size of area affected, and (3) location of area in relation to the longitudinal seam.

It is necessary first that the minimum thickness allowed for the maximum allowable working pressure desired be determined using the ASME Code shell or head formulas based upon the allowable stress for the material and construction used.

When the affected area includes, or is within 3 in. of the longitudinal seam, the efficiency of the seam shall be used for E in the ASME Code formula. If, however, the wasted area is in the solid plate, and does not approach within 3 in. of the longitudinal seam, E in the formula will be (1.0), as the efficiency of the seam need not be considered in making the minimum thickness computation. In calculating the minimum thickness for the desired working pressure, it is necessary that consideration be given to the actual working pressure at the portion of the digester being considered, taking into account the static pressure of the liquid at that point in the vessel.

If localized wastage has occurred over a relatively small area of a carbon steel digester, consideration may be given to protecting the corroded surfaces by means of weld overlay of corrosion-resistant material to prevent further wastage. This type repair should be considered only if the thickness of the shell or head has not been reduced below the required thickness for the maximum working pressure desired and after consultation with the insurance inspector.

The services of a qualified welding operator and a welding engineer or technician who has had sufficient experience to insure a satisfactory repair will be required. It is important that the overlay be applied in such a manner that it will completely cover the surface to be protected. During application, the heat generated by welding should be kept as low as possible to prevent the development of undesirable stresses in the repaired area.

A portion of a digester may become seriously corroded or eroded as a result of a local condition, such as a defective spray nozzle or an accelerated attack in the vicinity of a stock or other opening. Such areas in many cases may be repaired, depending upon the nature of the corroded area, so that a reduction in pressure will not be necessary. The condition should be discussed with the insurance inspector and a decision made as to the proper method of repair. A reduction in pressure is not necessary if the corroded area is such that it may be inscribed in an 8-in. diameter circle. In this case the average thickness over the area may be taken as the reduced thickness rather than the thinnest point.

Widely scattered pitting, although deep, is not considered serious enough to require a reduction in pressure. Such areas may be built up to the thickness of the surrounding plates provided approval of the insurance inspector is obtained and a proper welding procedure is used.

Large areas that have been reduced in thickness below the minimum permitted for the desired operating pressure will require a reduction in the operating pressure of the digester or major repairs. Such areas may be repaired by installing a new section, or an entire

course if such a repair is considered economically feasible. In making a major repair of this type, the insurance inspector must be consulted for approval and in many cases, the approval of the State authorities, if the vessel is located in a Code State, will be required. In any case, the repairs should be made by a qualified welder under the supervision of a welding engineer. If the vessel is a Code vessel, it will be necessary that the welder be qualified under Code requirements so that the digester may maintain its Code status.

ESTIMATE OF REMAINING SERVICE LIFE

The remaining service life of a digester will be a function of the desired working pressure. This pressure should not exceed the maximum allowable pressure for the digester. For safety consideration toward the end of the life of the digester, the working pressure may be reduced to whatever minimum is practical in order to obtain some additional life. For most considerations, however, in projecting the remaining service life of the digester, the desired working pressure, which should agree with the maximum safety valve setting, should be used.

In estimating the remaining service life, the minimum allowable thickness of the plate in a digester may be calculated using Code formulas with a factor of safety of 4, and as has been stated previously, ignoring the effect of the longitudinal seam unless the corroded area is within 3 in. of that seam. The effect of the static head of liquid within the vessel must be given consideration. A digester is said to have reached a state of having no remaining service life when the thickness of the metal reaches this predetermined minimum thickness.

The remaining service life of the digester is merely the time it will take for the most critical area in the digester to corrode to the predetermined thickness.

Various surface areas will have characteristic corrosion rates. Unless the inspector has reason to believe the contrary, a constant corrosion rate should be assumed for each area. If the inspections are made at a constant time interval and if thicknesses are recorded at the same point, then the average thickness is all that is needed to find this corrosion rate.

Even though an area corrodes at a relatively constant rate, it may have considerable variation in thickness at any time. This may be due to irregular corrosion in the past or the fact that the original plate is not homogenous. It is suggested that the remaining service life be determined by the time it takes the minimum thickness point in the most critical area to corrode at the constant corrosion rate to the minimum allowable thickness for that area in the digester.

PROTECTION OF DIGESTERS

The need for providing adequate overpressure protection on digesters to protect against excessive internal pressures has long been recognized.

The possible causes of overpressure can usually be determined for most installations. Among these possible causes would be (1) failures of automatic flow, temperature, or pressure control valves, (2) overfilling of a digester, (3) closing of all outlet valves while vessel is idle, (4) vapor generation due to fire, and (5) failure of reducing valve on the main steam supply line.

Safety devices can be sized with reasonable accuracy provided information is available regarding line sizes, reducing valve capacities, and line pressures. The relieving capacity of the safety devices should be ample to meet the most severe conditions, if possible.

A safety valve shall be set to open at a pressure not exceeding the maximum allowable working pressure of the vessel at the operating temperature. However, if more than one valve is used, only one valve need be set to open at a pressure not exceeding the working pressure of the vessel. The additional valve or valves may be set to open at a higher pressure, but not to exceed 105% of the maximum working pressure allowed.

In digesters using steam as a direct cooking medium there would be no increase in pressure in the digester after the steam supply is shut off. In a case of this kind it is permissible to attach the safety valve to the main steam supply line. In the event there is no other pressure source that may cause an overpressure within the digester, there may be a stop valve between the digester and the safety valve. As a precaution in a case of this kind, it should be determined that the pump supplying cooking liquor to the digester is not of sufficient capacity to cause an overpressure in the digester, or that the pump discharge is protected by safety valves to prevent a pressure in excess of the working pressure on the digester.

When the indirect cook method is used, a safety valve should be connected to the digester in the vapor space. Safety valves should be so installed that their proper functions will not be impaired by the nature of the contents.

It is important that the safety valves be examined at the time of each internal and external inspection of the digester. Periodic manual operation of the valves is recommended to determine that they are in proper operating condition.

When the steam supply is limited by the safety valves on the boilers within the maximum operating pressure of the digester, individual safety valve protection of the digester is not required. As operating and installation practices in the many paper mills vary considerably, it is impossible to cover the protection required to meet all conditions. In any case, the inspector should carefully consider all possibilities and determine that the digesters are protected against excessive steam or liquor pressure from all sources of supply.

SUMMARY

The visual examination of a digester, including the completion of the TAPPI Data Sheet and the obtaining of thickness determinations of the shell and head are important parts of the inspector's work. Based on the information developed on the data sheets covering the above stages of the examination, an interpretation of the results may be made to locate critical areas and determine the safety status of the digester. Any repairs required will be determined and a check made with the insurance inspector as to whether the repairs are feasible. Also, based upon the information developed, the estimate of the remaining service life of the digester may be obtained.

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A New Paper Machine Drying Control System

J. M. McALEAR

The advantages of the new Mason-Neilan automatic moisture drying control system for paper machines is described. Information obtained from field experiments and actual applications is reported. Significant operational savings and improvements in paper quality are disclosed. The system is suitable for moisture measurement and control on virtually all grades of paper and on single or multiple section paper machines.

Prior to 1950 one method for controlling paper moisture on paper machines was a combination unit known in the trade as Tenso-Temp. This control system employed a weighted tension roll riding the sheet of paper and as the sheet tension changed due to a new moisture content, the roll position changed. This movement was employed to actuate an air pilot valve whose output pressure then, automatically shifted the index setting point of a proportional temperature controller and thus the heat content used for paper drying was automatically varied to the machine.

The tension roll was in contact with the sheet of paper over its entire width and had the advantage that it responded to the "average" moisture change. Some disadvantages to the system were that the roll was affected by a change in "draw" adjustment, it was not suitable for very light sheets as the paper would not support the weight of the roll, and conversely not suitable for heavy board sheets as such sheets had virtually no change in tension with moisture content change. New advances in paper machine design, particularly those involving higher machine speeds and greater widths, began to obsolete the use of this previously satisfactory control system. Only a few years ago, there were few machines operating at speeds above a thousand feet per minute and very common machine widths were for trims in the vicinity of 154 in. Now, new machine designs are for speeds of 2000 f.p.m. and trims of 280 in., and the trend is toward still higher speeds and wider machines. Such machine speeds, would require a tension roll of 16 in. minimum diameter and the problems of installation, clearance between driers, plugging during a paper break, plus the continual maintenance problem to keep it in good working condition and balance are apparent.

With the advent of these high-speed machines a development program for a better method of paper moisture measurement and control was instituted. In the laboratory and in the field, many mechanical and electrical principles were investigated and it became evident that a good measuring and controlling device should be able to measure the "average" moisture content across the entire width of the sheet rather than measuring and controlling from one "spot." Furthermore, the system, when developed must be as simple as possible utilizing commercial instruments which would be easily understood by machine operators and could be serviced by regular instrument technicians.

The largest variable which will cause a variation in total steam required for drying is the sheet moisture. Therefore, the total condensing load of a machine must vary for different moisture contents and similarly each drier's load must be a variable. This was the theory which was tested as it was felt that by isolating one drier there would be a moisture responsive element which would respond to the average moisture content of the sheet. Field tests were run on a paper machine having 32 5-ft. driers whose design speed was 2000 f.p.m. and whose trim was 208 in. The machine produced a variety of kraft specialties varying in weight from 25 to 85 lb.

To obtain a true sense of condensing values, one drier on the dry end section was fed with a separate steam source and a measurement of steam flow to it was recorded on a flowmeter using a straight edge orifice and the condensate and flash steam from this drier was collected and weighed. A constant pressure upstream of the orifice plate was automatically held with a control valve and controller and similarly a constant drier pressure was maintained with a control valve and pressure instrument. Thus, everything was done to obtain a positive check on condensing rates of the selected drier, and a double check of the total steam being condensed at given speeds and for a specific weight of paper requiring a final moisture content at the calender stack of 6%. For example, a 38-lb. kraft sheet and a machine speed of 1500 f.p.m. and a drier steam pressure of 25 p.s.i.g. showed a condensing rate of 1336 lb. per hr. on the steam flowmeter and a condensing rate by actual weight measurement by means of scales of 1356 lb. per hr. On this specific sheet, an increase of 2 lb. was made in basis weight and an increase in condensate rate was noted to 1376 lb. per hr. which was only a 2% increase in condensing rate and actually was hardly visible on the flow recorder chart. From these initial tests it was quite evident that the condensing rate of a selected drier was proportional to the moisture content of the sheet, and that the principle of using a separate drier for measurement was quite sound. This means of measurement gave an "average" means of pickup and control and at the same time did not detract from the over-all efficiency of the machine as it was later found that the measuring drier could be controlled at the same pressure or even higher than the main section without the loss of a single drier due to low pressure operation.

The condensing rate change of a single drier is not large for normal moisture variations of the average sheet and it became evident that if the sample drier idea was to be used, it would require instrumentation which could amplify the primary signal and yet permit the use of narrow proportionality in the instruments.

James M. McAlear, Manager, Pulp & Paper Dept., Mason-Neilan Regulator Co., Boston, Mass.

It was known from past experience that the control loop in a moisture drying control system is subject to an inherent lag, since a substantial period of time is required between the initial response to a moisture change and the return of sheet moisture toward a selected value by means of a change in heat input to the main drying section. This time lag tends to cause instability and the use of wide porportional band settings. Therefore, it became necessary to provide a sensitive response to sheet moisture change in order to avoid introducing additional time lag, as otherwise the accumulated time lag in the control loop would produce instability or else a desensitized system.

There were many ways in which the steam could be controlled to the sample drier and many experimental tests were run. For example, a constant steam input was measured and controlled to the sample drier, which resulted in a fixed steam pressure in the sample drier for a given set of standard paper and machine conditions.

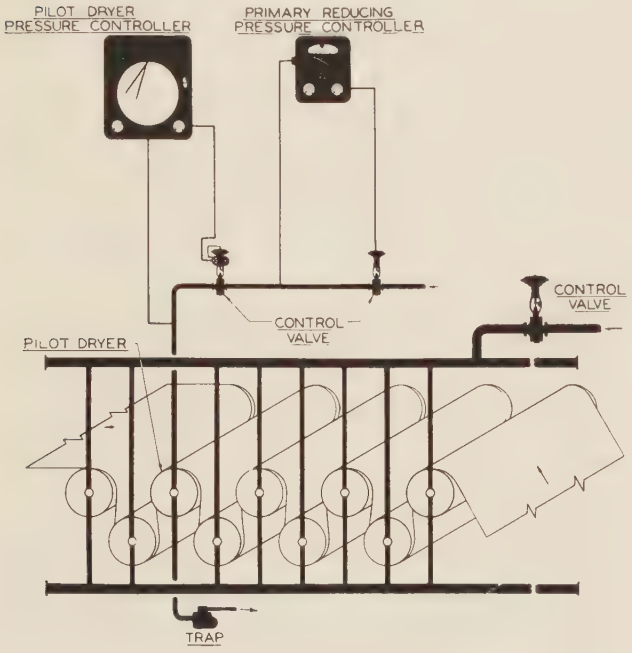

Fig. 1

A moisture change caused by a new sheet condition was thus measured by the sample drier pressure. The pressure in the sample drier could only be changed by changing the B.t.u. heat content in the drier. Since this change must be accomplished by the paper, a definite quantity of paper of a given moisture content and temperature must pass over the drier to effect a given change in sample drier pressure. This quantity or weight of paper requires a definite time to pass over the drier. For example, disregarding the specific heat of the drier shell, assume that a sheet having a 5% moisture content is passing over the drier and that drier is subjected to steam at 25 p.s.i.g. Assume further that each 1 p.s.i.g. change in pressure requires a 1000 B.t.u. change. Further, assume moisture content of the sheet is suddenly increased to some new moisture content, the pressure in the sample drier will start to decrease and the decrease will continue until a new equilibrium is finally obtained at perhaps 24 p.s.i.g. During this time interval, 1000 B.t.u. heat transfer from the drier to the sheet has occurred and the new value of drier pressure would be reached as an exponential func-

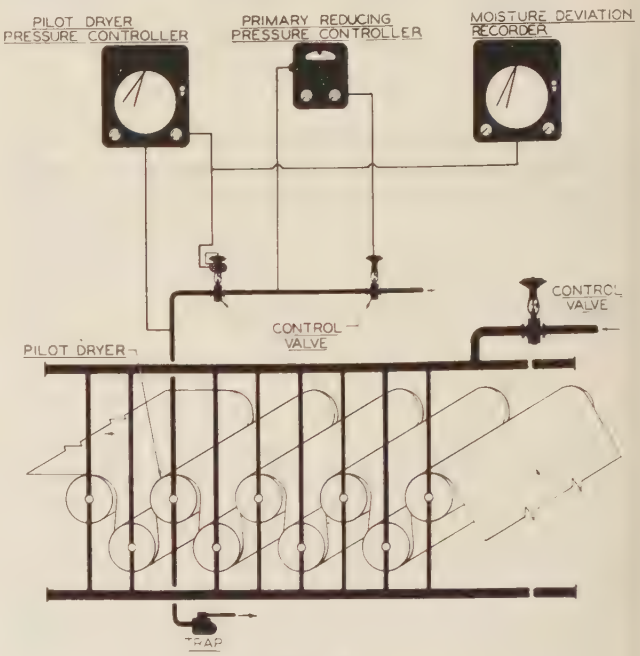

Fig. 2

tion of time. The time lag involved in the response to sheet moisture change, combined with the normal time lag inherent in the control loop and the tendency toward instability, is then materially increased. Tests on this type of system proved that primary moisture response from a variable sample drier pressure, was not stable without using wide proportional band settings on the instruments and this resulted in corresponding slow machine responses and wide moisture changes.

Another system which was tried was the use of a fixed straight edged orifice installed in the steam line to the sample drier and a constant pressure held up-

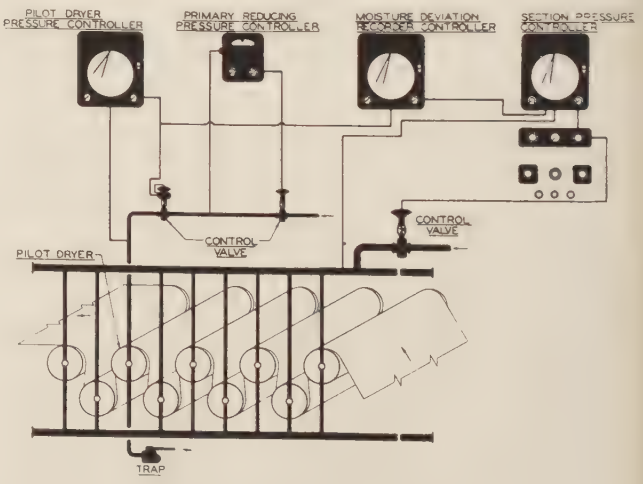

Fig. 3

stream of it. The change in pressure drop across the orifice was measured by a flow instrument, and the change in pressure drop across the orifice used as a meas-

ure of sheet moisture, and this differential pressure was effected by the change in condensing load. While the flow through the fixed orifice increases somewhat

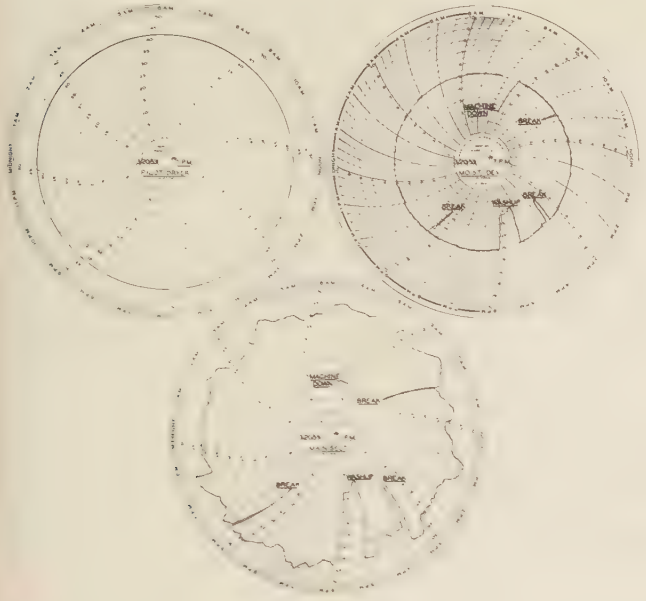

Fig. 4

as the pressure drops in the drier, and therefore the final pressure change is not as great as that required in the flowmeter type of control, wherein a constant steam input is maintained, nevertheless a definite pressure drop is required which takes place over the period of time determined by the cooling effect accorded by whatever quantity of paper has to pass over the pilot drier, until the new B.t.u. equilibrium is reached. A further difficulty with the fixed orifice idea was that it was not adaptable to wide flow ranges, often encountered on various grades of papers and was frequently completely out of range and could not respond to moisture changes. Therefore, both the constant rate of flow steam input system and the system which responds to changes in rate of flow across a fixed orifice were discarded, because there was not immediate measurement of the moisture change and the time lag involved, combined

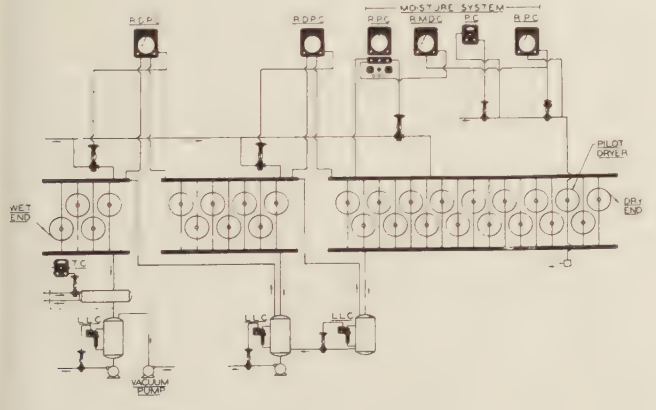

Fig. 5

with the time lag inherent in the control loop of the machine, produced great instability.

The final system which was adopted is described in Fig. 1. This system was fast in response and measurement and yet very stable. This system employs a pilot drier, a separate source of steam to it controlled by two pressure instruments and valves mounted in series. A fixed pressure is maintained upstream of the second control valve to eliminate any upset due to variable steam supply pressure. The second pressure control valve and instrument is used to maintain a fixed sample drier pressure. Any variation in sheet moisture will produce a new condensing rate for the sample drier and if the pressure in the drier tries to change, it is immediately corrected for by the pressure instrument sending a new air signal to the control valve which automatically adjusts the steam flow rate to the correct value. This variable air signal it was found, could be recorded and used as a permanent guide showing moisture deviation of the sheet (see Fig. 2). Finally, this variable air signal was transmitted from the sample drier control valve to the moisture recorder controller and the signal then amplified to the main section pressure controller. This instrument being equipped with pneumatic set feature automatically permits the index shifting of the control point so that the main section

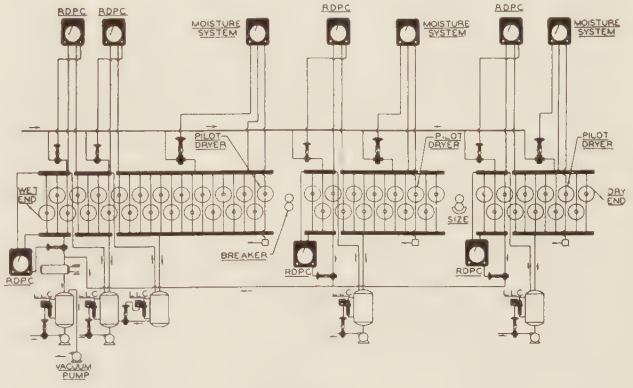

Fig. 6

drying pressure can be set to any desired pressure. The complete control system is illustrated in Fig. 3. A valuable item was developed for automatically handling the steam to the entire machine during a paper break, thus relieving the operator of this duty, and aiding in the fast restoration of the sheet to the machine. When the paper breaks, the drying load of the pilot drier is reduced and the control loop works in the same direction as if the sheet had gone through the drier so that the steam pressure in the main section is automatically set down to a lower pressure and held at this point until the sheet is restored. The minute the sheet is back on the machine the main steam valve is automatically opened and the required drying pressure automatically set. This automatic break mechanism helps to prevent additional dry breaks, it avoids wet paper on the reel, it gives, through indicating lights, information to the operator as to whether the system is on "moisture control" "paper break," or "straight pressure control." Figure 4 shows typical recordings of a 24-hr. operation, illustrating complete automatic handling of the machine during upset conditions produced by breaks and washups. This system is not only suitable for single

section machines, see Fig. 5, but is exceptionally useful for multiple section machines where breaker stacks or size tubs are used, or if continuous machine coating is employed (see Fig. 6). The system, therefore, has the ability to control over a wide range of moisture content and in fact, many installations are in use where the moisture content is held as low as 3% and as high as 50%. Great economies can result from the use of this system and therefore, greater profits result. One mill manufacturing board states that their production is up 7% per day since installation of this system while apparently using less steam. Another mill manufacturing dissolving pulp increased tonnage by 10%, and rejects due to incorrect moisture, dropped from 10 to 1%. Not only do profits result from increased tonnage, but greater uniformity is obtained and therefore better quality. There is less down time due to dry breaks and quicker recovery after breaks, as the system handles the steam to the machine under all conditions.

The system is invaluable in pointing out machine troubles as they develop. For example, if there is poor steam circulation, a higher machine steam pressure for drying will be required. If the driers are improperly drained, usually an intermittent cycle of steam pressures will result. For changes in press operation, freeness, consistency, felts or air removal, the pilot drier condensing load changes and thus automatically establishes the correct drying pressure.

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Wash Water and Wash Water Heating

MAURICE KLEIN and JOHN M. RALSTON

The requirements of the wash water used on the diffusers and pulp washers at the Savannah plant of the Union Bag & Paper Corp. are presented. The system for heating the hot wash water is described with illustrations. Digester blow steam is condensed directly with the fresh water make-up in jet condensers. Instrumentation of the system is designed to control the temperature of the hot water to the washing equipment, accumulate the maximum amount of heat, and control the flow of fresh water make-up. A discussion of the operating difficulties encountered and steps taken to correct some of these difficulties are presented. Waste heat from an evaporator surface condenser is used to heat part of the water supplied the hot water system. Other sources of waste heat are available if the need for additional heat should arise.

Removing and recovering spent cooking liquor is recognized as an important step in the kraft process. The three types of washing equipment generally used for the removal of black liquor are the diffuser, the rotary vacuum pulp washer, and the screw press. Some degree of countercurrent washing (the use of wash liquor in decreasing strengths and finally wash water) may be used with all three types of equipment. Part or all of the wash water must be heated to obtain the maximum efficiency from the washing equipment. Whichever equipment is used, close attention to the washing operation will result in savings in chemicals, water, and heat.

Numerous papers have discussed the three types of equipment and countercurrent washing in general. An excellent discussion of the first two types including several references is given in Volume I of "Pulp & Paper Manufacture" (*1*). Screw presses have also been discussed (*2*). The diffusers and pulp washers which are used at the Savannah plant of Union Bag & Paper Corp. have both been discussed in previous papers (*3, 4*). This paper will discuss the hot and cold wash water requirements and the system used for heating the hot wash water at our plant.

Maurice Klein, Chemical Engineer, and John M. Ralston, Chemical Engineer, Union Bag & Paper Corp., Savannah, Ga.

WASH WATER REQUIREMENTS

The wash water requirements, quantity and quality, of a given mill depend on the type of washing equipment used, the type of pulp, and the cleanliness desired. Diffusers generally use more water than pulp washers. Pulp for bleaching or dissolving would require more thorough washing with water of higher purity than board pulp. In general, the wash water should be noncorrosive, only slightly scale forming, low enough in dissolved solids to allow efficient washing, and low enough in suspended solids to avoid plugging of shower nozzles, valves, or pumps.

Wash Water Consumption

At the Savannah plant of the Union Bag & Paper Corp. an average of about 1650 tons of kraft pulp are washed daily using three lines of Swenson pulp washers and 40 diffusers. The pulp washers are two lines of three 9 by 12-ft. two-stage drums and one line of three 9 by 14-ft. two-stage drums. They are operated as a five-stage system as the last drum in each line is used as a single stage. The original installation of two lines of 9 by 12-ft. drums has been previously described (*4*). The pulp washers use about 1700 gal. of 155°F. hot wash water per ton.

The diffusers are arranged in four circles of seven diffusers, 13 ft. in diameter and 26 ft. high, and one circle of 12 diffusers, 12 ft. in diameter and 29 ft. high. The latter 12 are equipped with Markila-Brax strainers and Sandberg dumping valves. The others are conventional diffusers. The diffusers all use about 4600 gal. of total wash water per ton not including the weak liquor used for starting the wash. The conventional diffusers use about 2000 gal. of 155°F. hot wash and 2600 gal. of cold wash per ton of pulp. Cold water is used to reduce the stock temperature before dumping in order to eliminate the safety hazard of hand dumping

hot diffusers. It has been found that the use of cold water to finish the wash does not appreciably increase the washing time for the conventional diffusers. Sealing water from the paper machine Nash pumps which is about 90°F. is used for the cold wash. The 12 diffusers with the Markila-Brax strainers and Sandberg dumping valves all use 155°F. hot wash water. As the hot water system has ample heating capacity, and as there is no danger to personnel, cold water is not used to complete the washing of these diffusers.

The hot wash water for diffusers and pulp washers averages about 2300 gal. per ton. The total hot wash water required at the present production rate is about 2600 g.p.m. and is expected to reach about 3100 g.p.m. when the expansion program now under way is completed. Two additional lines of Swenson washers are being installed for washing semichemical pulp as part of this expansion program. About 8% of the hot wash water is obtained as blow steam condensate from the direct blow steam heat recovery system. In addition to the water used for washing pulp, water from the hot water system is used in the caustic room and kiln room when condensate from black liquor evaporation is not suitable for this purpose.

Water Quality

The fresh water used in the plant is a mixture of about three-quarters artesian well water from our own wells and about one-quarter surface water from a municipal industrial supply. The well water, which has about 100 p.p.m. of total hardness, receives no treatment. The surface water is flocculated with alum, filtered, and brought back to the basic side with lime at the municipal industrial water plant. This water, which has a hardness of about 40 p.p.m., receives no further treatment at the plant except that portion which is used for boiler make-up. Except for this boiler make-up, the mixture of well and industrial water is used throughout the plant at all points requiring fresh water, including the hot and cold wash water.

Countercurrent Washing of Pulp

In addition to the washing done in the diffusers and pulp washers, some pulp washing is done by the fresh water added at the paper machines and at the screen room. The pulp system from the unscreened stock chests to the paper machines constitutes a countercurrent washing system. Fresh shower water is added at the paper machines. The excess water at the machines not needed for headbox dilution is used for washing on the deckers. Decker sealpit water is used for dumping diffusers, for dilution of the washed stock from the diffusers and pulp washers, and for knotter dilution. Excess decker sealpit water overflows to the sewer, removing considerable soda from the system. Considering the fresh water used at the paper machines and screen room as pulp washing water, about three-quarters of the fresh water used in the plant is used for washing pulp.

An extension of this countercurrent washing would be the use of decker sealpit water for washing pulp in the diffusers and pulp washers. The advantages of the use of decker water for washing would be a saving of fresh water, a reduction of stream pollution, and a saving of soda. Trials have been made of replacing part of the fresh water make-up into the hot water system with decker white water. These trials were discontinued because of difficulties attributed to other causes during a period of increasing production. Further trials will be made when the expansion program has been completed.

WASH WATER HEATING

Recovery of blow steam for heating pulp wash water has become an accepted practice in modern kraft pulp mills. The design of a particular system for heating wash water depends on the operating conditions at the mill and the requirements of the finished product. A hot water system must be able to supply the quantity of hot wash water required during peak production periods at the required temperature. When wash water requirements are low, the system should dispose of the excess heat without causing any variation in water temperature or creating a nuisance. A carefully designed and instrumented system will meet these requirements with a minimum of attention on the part of operators or maintenance personnel.

The value of a waste heat recovery system may be illustrated as follows: assume that a kraft mill making 1000 tons of pulp per day uses 2300 gal. of hot wash water per ton of pulp. If this water must be heated from 75 to 155°F. with live steam it would cost about $210,000 a year (at a steam cost of $0.40 per million B.t.u.). Thus by using waste heat, providing proper temperature controls, and installing ample tank capacities to take care of surges, considerable savings may be made.

Heat Available

The fresh water is about 75°F. as it enters the plant at Savannah. Heating the water required for washing pulp to 155°F. requires about 1,500,000 B.t.u. per ton of pulp. Measurements indicate that the blow steam from the diffuser cyclones to the jet condensers contains about 1,900,000 B.t.u. of heat above the fresh water temperature per ton of pulp. This does not include the heat lost from the diffuser vents. The heat recovered from blows to the pulp washer blow tanks is slightly greater because there is no vent loss in this case. (The digesters blow from full cooking pressure of 110 p.s.i.) With a direct blow steam heat recovery system such as is used in the Savannah plant, all of this heat is available for heating the wash water. If an indirect system were used, only the latent heat of the blow steam and possibly a small part of the heat in the condensate would be available for heating the wash water. With an indirect system 5 to 10% of the heat would normally be lost in condensate sent to the sewer.

In addition to the blow steam, heat is obtained for the hot water system from the last effect vapor of one of the evaporators. This vapor is condensed in a surface condenser which heats part of the make-up water for the hot water system to about 125°F. This supplies about 540,000 B.t.u. per ton of pulp to the hot water system. The make-up water not circulated through the evaporator condenser is heated to 80 to 85°F. by the recovery of used cooling water at various heat exchangers throughout the plant. The average temperature of the make-up water is actually about 100 to 105°F. instead of 75°F. as a result of these heat

economies. This temperature could be further increased by the use in the hot water system of other heated water, if additional heat were needed. These sources include cooling water from the Midwest-Fulton condensers, the recovery boiler spouts, and boiler fan bearings. However, for the present, surplus heat

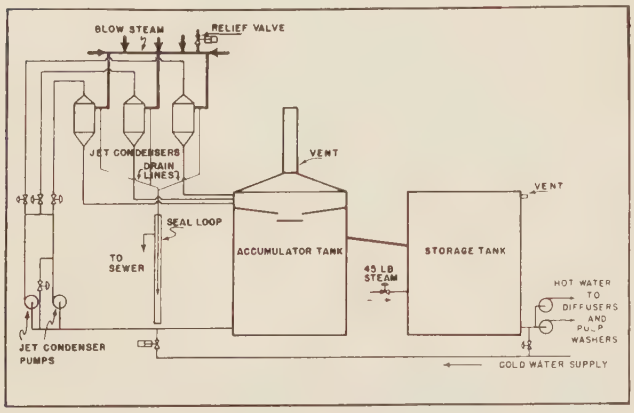

Fig. 1. Blow steam heat recovery flow diagram

is available and it is expected that the present system will provide hot water to two lines of semichemical pulp washers without the need for recovering blow steam from the semichemical blow tank.

Description of Hot Water System

A flow diagram of the blow steam heat recovery system now in use at Savannah is shown in Fig. 1. The blow steam from five diffuser cyclones and two pulp washer blow tank cyclones is condensed directly by the wash water being heated in three jet condensers which discharge into an accumulator tank. The cool water at 100°F. either enters the bottom of the accumulator tank or the suction of the pumps to the jet condensers. Hot water overflows from the top of the accumulator tank into the storage tank which supplies the pumps to the diffusers and pulp washers. As the wash water requirements are quite variable, and as the digester blows are not uniformly spaced, there is need for a large storage of heat. The accumulator tank serves to store heat from several blows. During a series of blows, all of the water in the accumulator tank becomes heated at the jet condensers. Between blows the accumulator tank continues to supply hot water to the storage tank until all of the hot water has been replaced with the cool fresh water. While the storage tank also has some capacity for accumulating heat, its main purpose is to maintain, for a short time, the supply of wash water in case of a temporary failure of the fresh water supply.

The hot water system at Savannah was originally an indirect system. The water circulated through the jet condensers was not used for washing pulp but was only used for heating other fresh water. Water from the accumulator tank was circulated through spiral and tubular heat exchangers and then returned to the accumulator tank. Fresh water was heated in the heat exchangers and sent to the storage tank from which it was used for washing pulp. Carryover of fiber and rejects into the jet condensers and accumulator tank caused frequent plugging of the heat exchangers. Conversion to the direct system has eliminated this problem. However, carryover is still a problem and will be further discussed later. While it might be expected that odor in the blow steam would cause an odor in the finished product, no reports have been received of odor due to this cause.

Instrumentation

The instrumentation of the blow steam heat recovery system is designed to maintain the desired temperature, to control the flow of water to the system as needed, to relieve any excess digester blow steam to the atmosphere, and to indicate difficulties. Figure 2 shows a view of the very simple instrument panel which is located at the digester operating level. The instrumentation of the system is shown in Fig. 3. The symbols used in this figure are those used by the Instrument Society of America. The instruments shown in Fig. 3 are used as follows:

Fresh Water Make-up (1 on Fig. 3). Flow of cold fresh water to the accumulator tank is controlled by the level in the hot water storage tank. This flow can be controlled by the accumulator tank level when it is necessary to shut down the storage tank for repairs. Levels in both tanks are recorded on one chart.

Temperature Controls

Jet Condenser Temperature (2 on Fig. 3). The flow of cold water to the jet condensers is controlled by a butterfly valve in the line to each jet condenser. Normally, these valves open during a blow to control the temperature in the discharge from the jet condensers at about 190°F. Between blows these valves close to prevent cold water from mixing with hot water in the top of the accumulator tank.

When more heat is being supplied to the system than is needed for the hot wash water, the entire accumulator tank becomes filled with hot water. When this happens the circulation of water through the jet condensers can

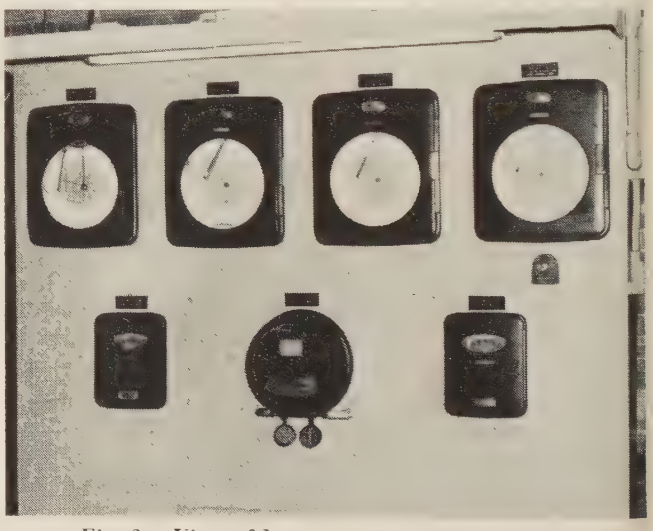

Fig. 2. View of hot water instrument panel

no longer condense blow steam. If water continues to circulate at this time, the mixture of boiling water and steam in the jet condensers and lines to the accumulator tank sets up considerable vibrations in the system. To avoid this a second temperature controller is incorporated in the system. This controller shuts off the

water flow to the jet condensers when all the water in the accumulator tank has been heated. This temperature controller also opens a relief valve on the blow steam header (5 on Fig. 3) to prevent a build-up of pressure in the vapor lines.

Wash Water Temperature (3 on Fig. 3). The storage tank is maintained at a higher temperature than that at which the water is to be used. This gives the tank a greater surge capacity. The water which is pumped to the diffusers and washers is cooled to the control temperature by the addition of cool water from the same source used for make-up to the system. The cold water is added to the suction side of the wash water pumps through an automatic control valve which is actuated by the temperature at the discharge side of the pumps. The use of this temperature controller permits the control of the wash water temperature with only a few degrees of variation, except during periods when insufficient heat is available. It would not be possible to maintain such close control without this instrument.

Emergency Heat Supply (4 on Fig. 3). During periods when insufficient blow steam is available, such as during a plant start-up or when there are long periods between blows, it is necessary to add steam through a jet in the bottom of the hot water storage tank to maintain the temperature of the wash water. The steam is added through an automatic valve which opens when the temperature in the storage tank falls below 150°F. The temperature at this point is normally about 180 to 200°F. and no additional heat is needed during normal operation.

Pressure Controllers

Blow Steam Pressure Relief (5 on Fig. 3). High pressure in the blow system is undesirable because of the possibility of the pressure causing stock to blow out of diffuser vents. A 20-in. automatic relief valve re-

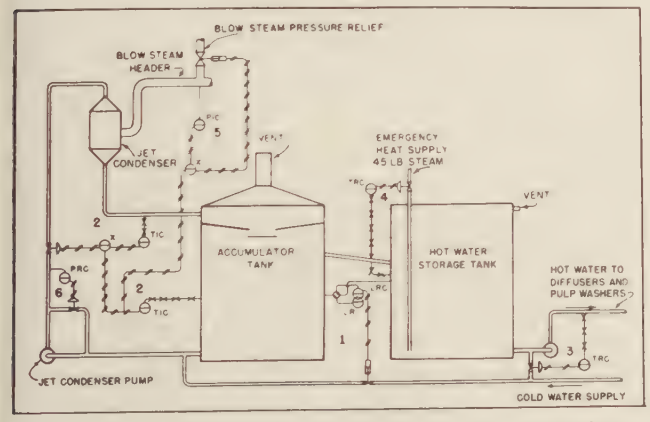

Fig. 3. Blow steam heat recovery—Instrumentation

LR, level recorder; LRC, level recorder controller; PIC, pressure indicator controller; PRC, pressure recorder controller; TIC, temperature indicator controller; TRC, temperature recorder controller; X, air relay.

lieves blow steam to the atmosphere when the pressure in the vapor lines to the jet condensers exceeds 3 p.s.i. This is the same automatic valve mentioned above which relieves the blow steam to the atmosphere when all the water in the accumulator tank has been heated. This high pressure would be due to the accumulator tank becoming filled with hot water or to steam flowing to the jet condensers from several blows at one time. The cyclones, blow tanks, and vapor lines are further protected against dangerous pressures by weight loaded relief valves on each cyclone.

Pressure Relief on Jet Condenser Pumps (6 on Fig. 3).

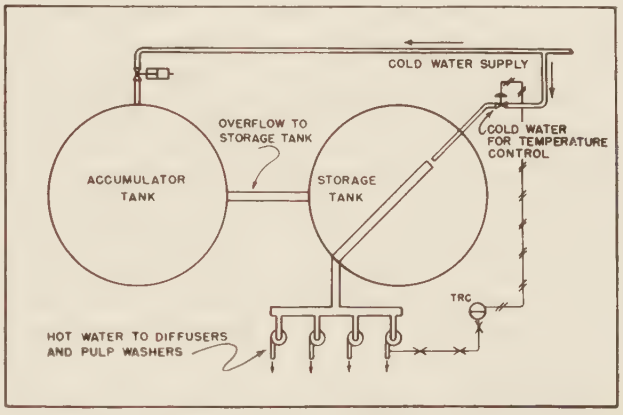

Fig. 4. Temperature control of hot wash water

Extension of suction pipe to improve mixing of hot and cold wash water.

Maintenance on the jet condenser pumps has been quite high, which is believed to have been partially due to the pumps operating on hot water against closed valves. An automatic valve allows water to circulate around the pump when the pressure exceeds the normal value which occurs when the control valves close off.

Operating Difficulties

Operating difficulties have been caused mainly by scale formation, fiber and liquor carryover with the blow steam, improper temperature control caused by poor mixing of the cooling water with the hot water, and insufficient capacity for accumulating heat. Salts in the make-up fresh water are the main source of scale. The well water has slight scale-forming tendencies at normal temperatures. This scale-forming tendency increases with increasing temperature. The probable composition of two typical scale samples is shown in Table I. These scales are principally calcium carbon-

Table I. Probable Composition of Typical Scales from Hot Water System (Calculated from Analyses) in Per Cent

A. Accumulator tank:		B. Pulp washer showers:	
Organic	28.3	Organic	1.5
$CaCO_3$	15.6	$CaCO_3$	93.0
Excess Ca as CaO	2.2	$MgCO_3$	5.8
Sodium as Na_2O	0.1	Na_2CO_3	0.1
$Mg_3Si_4O_{11} \cdot H_2O$	37.3	HCl insoluble	0.2
Excess Mg as MgO	11.6	Total	100.6
HCl insoluble	4.8		
Total	99.9		

ate and magnesium silicates combined with fiber and knots. Thick deposits build up on the walls of the jet condensers and accumulator tank until they break loose. Large pieces which break loose may lodge in pipe lines and plug them. The pipes from the jet condensers to the accumulator tank and the line from the accumulator tank to the storage tank have plugged. The recent introduction of the municipal industrial water, having a lower hardness and silica content, into the fresh

water system should reduce the scale-forming tendencies and the difficulties which have occurred from scale formations. Deposits have also occurred in the hot water lines to the pulp washers and in the shower nozzles. These were believed due to a temperature control problem to be discussed later which allowed water of 170°F. or higher to be used at these points. It is hoped that the improvement which has been made in the temperature control will reduce this scaling.

Carryover of knots and fiber has also contributed to the plugging of the overflow lines between the accumulator and the storage tanks. Knots and fiber settled out in this line, probably due to the low velocity when the water level in the storage tank was above the discharge end of the line. This line was replaced with one which eliminated several turns and entered the storage tank high enough so that the water level could be maintained below the pipe outlet. As the pipe does not run full under normal flows, this change has increased the velocity and it is hoped will prevent the buildup of material in the pipe. Eight-inch drain lines, installed in each of the blow steam lines before the jet condensers, remove some of this material. These lines are sealed in a seal loop as shown in Fig. 1. However, some carryover through the condensers still exists and it is necessary to inspect and clean out the accumulator tank and jet condensers on nearly every shutdown.

While the carryover of fiber and knots into the hot water system still causes difficulties, these are considerably less than were experienced with the indirect heating system. With the indirect heating system, any knots and fiber not removed by the strainers accumulated in the system due to the recycling or plugged the heat exchangers. With the direct system, the wash water carries off considerable fiber and knots continuously. As about 65% of the water is used for washing diffusers, a large part of the carryover fiber and knots is recovered. It is necessary to remove knots from the pulp washer wash water to prevent plugging of the showers. A strainer with $^1/_8$-in. perforations is used to filter this water. The material removed is discarded.

Liquor entrainment with the blow steam increases the soda content of the hot wash water considerably at times. Entrainment in the blow steam normally raises the soda content of the hot water only slightly above that of fresh water, from about 0.4 lb. (expressed as Na_2SO_4) per 1000 gal. to about 0.5 lb. per 1000 gal. However, during short periods of liquor and pulp carryover the soda content has reached 12 lb. per 1000 gal. These short periods of carryover raise the average soda content of the hot wash water to about 1.0 lb. per 1000 gal. Except for these short periods, the normal small liquor carryover or entrainment has not caused any difficulties in washing pulp. Frequent inspections and repairs to the wear plates in the diffuser cyclones and blow tanks help keep carryover to a minimum.

Several pumps take water from the storage tank for the diffusers and pulp washers. As mentioned above, the temperature of this water is controlled by adding cold water through an automatic valve to the suction of the pumps. The automatic valve is controlled by the temperature at the discharge of one of the pumps. Under certain conditions the water temperature was not the same from all the pumps. It was being controlled at the bulb of the temperature controller but was varying widely at the other pumps. High temperature of the water used at the pulp washers caused loss of vacuum and scaling of hot water lines and nozzles. It was found that there was insufficient time for the cooling water to mix with the hot water before the flow was split at the header to the hot water supply pumps. There was no room to lengthen the suction piping on the outside of the tank to provide better mixing of hot and cold water. The pipe was extended through to the other side of the tank and the cold water was admitted into the opposite end as shown in Fig. 4. This change has improved the mixing of the hot and cold water and the temperature control is now satisfactory.

When blows are not distributed uniformly, there are occasional periods when all of the hot water in the accumulator tank is used up and cold water begins overflowing into the storage tank. If, after a series of blows, the accumulator tank is completely filled with water at 190°F., it will contain enough heat to supply 155°F. wash water for about 27 min. at the normal wash water flow. The storage tank has an additional 25 min. of capacity but this capacity may not be completely available. In fact, it is quite possible that cold water entering the top of the storage tank will drop immediately to the bottom because of its greater density and be used before the hot water above it. During such periods, steam must be used and at times the steam supply is not adequate to maintain the temperature of the hot water. A larger accumulator tank would reduce these difficulties.

CONCLUSION

Blow steam is a substantial source of heat for wash water heating. A mill using only diffusers may not have ample heat from blow steam for diffuser washing unless part of the diffuser wash is cold water. At Savannah, ample heat is available for wash water as (1) about half of the pulp is washed in pulp washers which use only one third the wash water required by diffusers, (2) the conventional diffusers use cold water to complete the washing, and (3) other sources of waste heat are available. Careful instrumentation is necessary for the efficient operation of a system for heating wash water.

The use of a direct system for condensing blow steam has eliminated certain difficulties experienced with the indirect system and has increased the heat recovery. Carryover of rejects and liquor with the blow steam still causes some operating difficulties. It is felt that the direct system is quite satisfactory for heating wash water for unbleached kraft pulp and is to be recommended over the indirect system for such pulp.

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3. Gothner, K. F., and Robson, H. T., *Tappi* 35, No. 8: 370–373 (Aug., 1952).
4. Klein, Maurice, McCall, F. S., and Lientz, J. R., *Paver Trade J.* 124, No. 5: 44–49 (*T.S.* 52–57) (Jan. 30, 1947); *Tech. Assoc. Papers* 30: 562–567 (June, 1947).

Received Oct. 23, 1952. Presented at the Seventh Alkaline Pulping Conference of the Technical Association of the Pulp and Paper Industry, Houston, Tex., Nov. 18–20, 1953.

ASSOCIATION NEWS AND EVENTS

Salute to the Paper Industry

A feature of the Annual Meeting of the Technical Association was the coast-to-coast technician broadcast on February 17, sponsored by the American Cyanamid Co., over Channel 7, which saluted the paper industry.

The program originated in the Ritz Theatre of the American Broadcasting Co. and was a documentary, a cavalcade of paper from confetti to paper bathing suits, produced by Eddie Nugent, one of video's best known production names. It dramatized the value and contributions that paper has made, is making, and will make in the future.

In addition to numerous interviews of executives of the industry the new midget paper machine brought to the United States from Germany was shown in action in the lobby of the Commodore Hotel.

Coating Conference

Plans are progressing for the Fifth Annual Coating Conference of TAPPI to be held at the Poland Spring House, Poland Spring, Me., on May 24–26, 1954.

The meeting will be featured by visits to the mills of the Oxford Paper Co., Rumford, Me., S. D. Warren Co., Cumberland Mills, Me., and the St. Regis Paper Co., Bucksport, Me.

The keynote address will be made by R. W. Hovey, executive vice-president of the Oxford Paper Co.

There will be a symposium on laboratory and pilot-plant development techniques for paper coaters. About twenty-five speakers will participate under the direction of J. T. Loomer of Robert Gair Co., Uncasville, Conn., program chairman, and Harris Ware of the Hercules Powder Co., panel moderator.

There will be an interesting exhibit of testing instruments which is being arranged by W. R. Willets of the Titanium Pigment Corp.

R. T. Trelfa of the Watervliet Paper Co. is chairman of the TAPPI Coating Committee which is sponsoring the conference. J. J. Thomas of the S. D. Warren Co. is chairman of the Coating Conference.

Assisting Mr. Thomas are J. T. Loomer, Harris O. Ware, G. S. McKnight, Jr., Oxford Paper Co., J. E. Wilber, St. Regis Paper Co., A. C. Zettlemoyer, National Printing Ink Research Institute at Lehigh University, J. G. Bullard, Corn Products Refining Co., F. N. Sprague, St. Regis Paper Co., A. D. Bonnano, The Kelco Co., W. R. Willets, Titanium Pigment Corp., and C. G. Landes, American Cyanamid Co.

Room reservations should be made with the Poland Spring House, Poland Spring, Me.

Local Section Meetings

Pacific: May 20–22, 1954. Gearhart Hotel, Gearhart, Ore. Joint meeting with Pacific Div., Superintendents Association.

Lake States: April 13, 1954. Forest Products Laboratory, Madison, Wis.

Delaware Valley: March 25, 1954. Engineers Club, Philadelphia, Pa., April 27, 1954. Mill Instrumentation.

Kalamazoo Valley: April 1, 1954. Hotel Harris, Kalamazoo, Mich. Engineering Meeting. George H. Pringle, President, TAPPI speaker.

New England: March 19, 1954. Hotel Bond, Hartford, Conn. Speakers—Harold Orford, Rutgers University, New Brunswick, N. J., and John Hinchen, Monsanto Chemical Co., Springfield, Mass.

Ohio: April 11, 1954. Hartwell Country Club, Cincinnati, Ohio. Annual meeting.

Empire State: June 10–13, 1954. Whiteface Inn, Lake Placid, N. Y.

Empire State (Metropolitan District): April 13, 1954. Fraunces Tavern, New York, N. Y.

Empire State (Northern District): April 5, 1954. Watertown, N. Y.

Empire State (Central District): May 7, 1954. University Club, Syracuse, N. Y. College of Forestry Students Night. C. H. Kent, Hercules Powder Co., Holyoke, Mass., speaker.

Empire State (Eastern District): March 18, 1954. Glens Falls, N. Y. "Centrifugal Cleaning Equipment." April 15, 1954. Glens Falls, N. Y., Junior Paper Presentation Competition.

Empire State (Western District): April 14, 1954. Park Hotel, Lockport, N. Y. W. S. McClintock, Armstrong Cork Co., speaker.

Maine-New Hampshire: June 18–19, 1954. Marshall House, York Harbor, Me. Symposium on "Recent Advances in Pulping Techniques."

Lake Erie: Hotel Carter, Cleveland, Ohio. March 19, 1954. "Chemical Aids for the Paper Maker and Paper Converter." April 16, 1954. Hotel Carter. "Modern Woman Dictates Today's Product Development."

Southeastern: March 19–20, 1954. George Washington Hotel, Jacksonville, Fla. May 14–15, 1954. De Soto Hotel, Savannah, Ga.

CPPA Technical Section: June 14–17, 1954. Empress Hotel, Victoria, B. C. Summer meeting.

APPM Superintendents Association: June 20–23, 1954. Sheraton-Mt. Royal, Montreal, P. Q.

Report of the Tellers Committee

Joseph T. Loomer, Robert Gair Co., Uncasville, Conn., and chairman of the Tellers Committee, reported the results of the mail ballot for election of Association officers and executive committeemen. His associates on the committee were C. G. Landes, American Cyanamid Co., Stamford, Conn., and Harris Ware, Hercules Powder Co., Wilmington, Del. The committee reported as follows:

We, the members of the Tellers Committee, having made a canvass of the official ballot for officers and members of the Executive Committee for 1954 of the Technical Association of the Pulp and Paper Industry, have found that the following have received a majority of the 1077 votes cast:

President: George H. Pringle, Mead Corp., Chillicothe, Ohio
Vice-President: K. O. Elderkin, Bowaters Southern Paper Corp., Calhoun, Tenn.
Executive Committeemen (to serve three years): Roy L. Davis, Detroit Sulphite Pulp & Paper Co., Detroit, Mich.; Ward D. Harrison, Riegel Paper Corp., Milford, N. J.; Fleming D. Long, Container Corp. of America, Chicago, Ill.; Robert I. Thieme, Scott Paper Co., Anacortes, Wash.

Tappi Editorial Board

The names of the members of the *Tappi* Editorial Board

appear on the contents page of this issue. There are twenty-two members of the Board. The dates following their names indicate the year of termination of their three-year terms.

At the end of 1953 the terms of the following members of the Board expired: W. D. Harrison, W. F. Holzer, Emil Heuser, H. F. Lewis, J. D. Malcomson, H. Mark, and E. C. Jahn. They have been succeeded by the following members of the Technical Association who will serve as members of the Editorial Board until the end of 1956:

L. K. Burnett, Ohio Boxboard Co., Rittman, Ohio
R. L. Davis, Detroit Sulphite Pulp & Paper Co., Detroit, Mich.
G. A. Day, Brown Co., Berlin, N. H.
W. M. Hearon, Crown Zellerbach Corp., Camas, Wash.
R. T. Nazzaro, Westfield River Paper Co., Russell, Mass.
R. H. Savage, Mead Corp., Chillicothe, Ohio
J. Weiner, Institute of Paper Chemistry, Appleton, Wis.
L. E. Wise, Institute of Paper Chemistry, Appleton, Wis.

An effort is made to maintain a balance of interest among the members of the Board. Each member is selected on the basis of his specialized interests in the various aspects of pulp and paper technology. The new members of the Board have specialized interest in the fields represented by the retiring members.

Research Appropriations Committee

The organization of the Research Appropriations Committee is established on the same basis as the structure of the Editorial Board. Each member is appointed to serve a term of three years and departs from the committee membership at the end of the service period. The members of the committee whose terms expired at the end of 1953 were Allen Abrams, A. E. Bachmann, and H. W. Bialkowsky.

The new members who have been appointed by the TAPPI Executive Committee to succeed them are:

James d'A. Clark, Longview, Wash.
Clark C. Heritage, Weyerhaeuser Timber Co., Tacoma, Wash.
W. W. Moyer, Crown Zellerbach Corp., Camas, Wash.
John L. Parsons of Waterville, Me., continues as Chairman of the committee

Wet Strength Monograph

During the past year or more the members of the Wet Strength Committee have been writing and rewriting material for a wet strength monograph. Individuals who have taken an active part in this work are as follows:

K. W. Britt, Chairman, Scott Paper Co., Chester, Pa.
J. E. Donohue, Hercules Powder Co., Wilmington, Del.
J. W. Estes, Scott Paper Co., Chester, Pa.
R. Goodale, Rohm & Haas Co., Philadelphia, Pa.
W. T. Griffiths, Milton Day Co., New York, N. Y.
I. J. Gruntfest, Rohm & Haas Co., Philadelphia, Pa.
L. E. Kelley, Rohm & Haas Co., Philadelphia, Pa.
G. C. Kimble, Union Bag & Paper Corp., Savannah, Ga.
H. J. Kurjan, C. H. Dexter & Sons, Inc., Windsor Locks, Conn.
A. L. Landesman, Fischer & Porter Co., Hatboro, Pa.
A. L. McConnell, Scott Paper Co., Chester, Pa.
C. S. Maxwell, American Cyanamid Co., Stamford, Conn.
J. P. Weidner, Container Corp. of America, Manayunk, Pa.

Report of the Secretary

The Technical Association of the Pulp and Paper Industry continued to grow in 1953 and had a year of very constructive activity.

Membership

There were 629 individual members elected in 1953; 226 resigned or were dropped from the membership. On Dec. 31, 1953, the total membership was 6025.

There were 15 corporate members elected in 1953; 7 corporate members resigned or were lost through mergers. The corporate membership on Dec. 31, 1953, was 244.

The following companies became corporate members in 1953:

d'Alizay, Soc. Ind. de Cellulose, Alizay, France
Celulosa de Chihuahua, S. A., Mexico, D. F.
Corning Fibre Box Co., Corning, N. Y.
Downing Box Co., Milwaukee, Wis.
Ganstoff-Courtaulds G.m.b.H., Koln-Weidenpesch, Germany
Govt. Forest Exp. Sta., Ministry of Agric., Tokyo, Japan
Hoague-Sprague Corp., Lynn, Mass.
Lenzinger Zellulose Papierfabrik A/G, Lenzing, Austria
Line Material Co., Sherman, Tex.
Menasha Wooden Ware Corp., Menasha, Wis.
Rohtas Industries, Ltd., Dalmianager, India
Rottneros Bruk, A/B, Rottneros, Sweden
Royal Container Co., San Francisco, Calif.
Tasman Pulp & Paper Co., Ltd., Auckland, N. Z.
Wartsila-Koncernen, A/B, Maskin och Bro., Helsingfors, Finland

There were 28 sustaining members elected in 1953; 3 sustaining members resigned. The membership on Dec. 31, 1953, was 227.

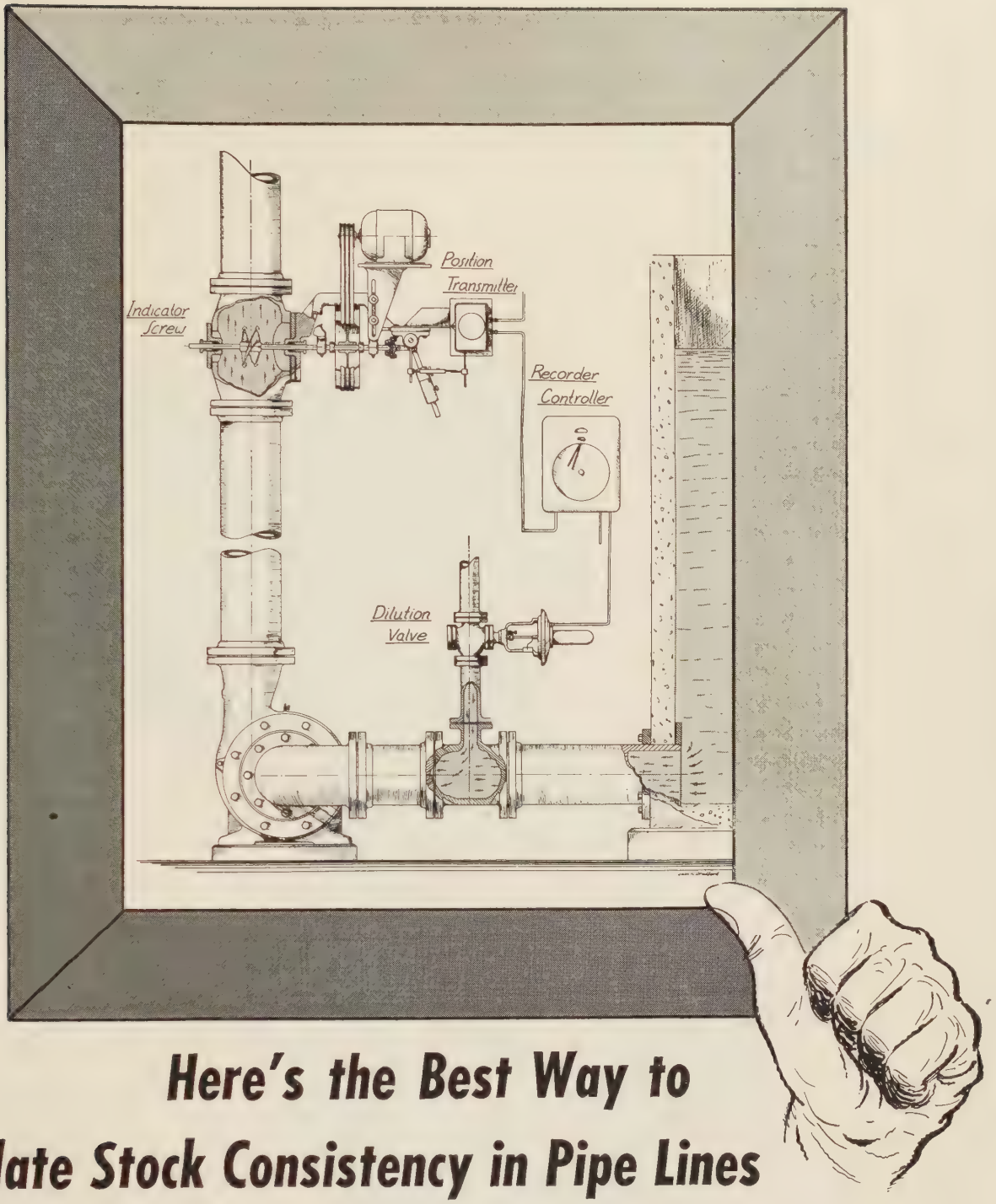
The following companies became sustaining members in 1953.

Alrose Chemical Co., Providence, R. I.
Appleton Woolen Mills, Appleton, Wis.
Arabol Mfg. Co., New York, N. Y.
Atlantic Refining Co., The, Philadelphia, Pa.
Bowser, Inc., Fort Wayne, Ind.
Cabot, Godfrey L., Inc., Boston, Mass.
Carpenter Steel Co., Alloy Tube Div., Union, N. J.
Crucible Steel Co. of America, Pittsburgh, Pa.
DeZurik Shower Co., Sartell, Minn.
Dowell, Inc., New York, N. Y.
General Corrugated Machinery Co., Palisades Park, N. J.
Gould Pumps, Inc., Seneca Falls, N. Y.
Hygrotester, Inc., Brooklyn, N. Y.
Keever Starch Co., The, Columbus, Ohio
Mixing Equipment Co., Inc., Rochester, N. Y.
Mount Hope Machinery Co., Taunton, Mass.
Owens-Corning Fiberglas Corp., Newark, Ohio
Saint Lawrence Starch Co., Ltd., Port Credit, Ont., Canada
Sandoz Chemical Works, Inc., New York, N. Y.
Sandusky Foundry & Machine Co., Sandusky, Ohio
Seelye Stevenson Value & Knecht, New York, N. Y.
Semet-Solvay Div., Petrochemical Sales, Allied Chem. & Dye Corp., New York, N. Y.
Swift, George W., Jr., Inc., Bordentown, N. J.
Tidewater Construction Co., Norfolk, Va.
Union Starch & Refining Co., Columbus, Ind.
Waterbury, H., & Sons Co., Oriskany, N. Y.
Wiegand, Edwin L., Co., Pittsburgh, Pa.
Wisconsin Wire Works, Appleton, Wis.

Necrology

The Association lost the following members through death:

Sture Andre, Stromsnas Bruks A/B, Stromsnas, Sweden
Frank F. Arnoldi, Hinde & Dauch Paper Co., Toronto, Ont., Canada
Elif Bang, A/S Tofte Cellulosefabrik, Oslo, Norway
Russell H. Bentz, P. H. Glatfelter Co., Spring Grove, Pa.
Charles Blodgett, Seaman & Seaman, New York, N. Y.
Harry C. Bradford, Rex Paper Co., Kalamazoo, Mich.
Leslie M. Clark, Imperial Chemical Industries, Ltd., Northwich, Cheshire, England
Nils Colliander, A/B J. W. Enqvist Oy, Lielahti, Finland
Edward T. A. Coughlin, Paper & Paper Products Unit, Dept. of Defense, Washington, D. C.
Adam Cunningham, Price Bros. & Co., Ltd., Kenogami, P. Q., Canada
P. W. Eason, Lathrop Paper Co., New York, N. Y.
Arthur J. Edward, Canadian International Paper Co., Three Rivers, P. Q., Canada
George C. Ehemann, Jr., The Ohio Boxboard Co., Rittman, Ohio
Norman C. Fairhead, Brompton Pulp & Paper Co., Ltd., Red Rock, Ont., Canada
William A. Fannon, The Fannon Trading Co., Appleton, Wis.
Emil Heuser, La Jolla, Calif.
James M. Kahn, Infilco, Inc., Chicago, Ill.
Werner Kaufman, Great Neck, L. I., N. Y.
Gerald H. Lafontaine, Howard Smith Paper Mills, Ltd., Montreal, P. Q., Canada
F. H. MacLaren, Standard Oil Co. of Indiana, Whiting, Ind.



Here's the Best Way to Regulate Stock Consistency in Pipe Lines

The Bird Consistency Regulator provides precise dependable control of stock consistency.

The sketch shows how it's done when stocks are of relatively high consistency. Pneumatic recording control is shown. Bird Regulators are also equipped with mechanical control if desired. Either way you may be certain of uniformly accurate constantly reliable regulation.

For consistency control anywhere in the pulp or papermaking process, the Bird Regulator is your best bet.

For precise control of BASIS WEIGHT, the Bird Regulator with float type indicator is just the ticket, as it takes care of consistency and volume.

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Roland N. Miller, Oxford Paper Co., Rumford, Me.
Harold A. Morrision, Oliver United Filters, Inc., New York, N. Y.
Robert D. Moynihan, Finch, Pruyn & Co., Inc., Glens Falls, N. Y.
Arno W. Nickerson, Consulting Engineer, New York, N. Y.
William E. Pomeroy, University of Maine, Orono, Me.
Don L. Quinn, Don L. Quinn Co., Chicago, Ill.
Edward E. Sawyer, Keyes Fibre Co., Waterville, Me.
Paul Schlosser, Rayonier, Inc., Shelton, Wash.
George K. Spencer, retired, Johnsonburg, Pa.
George A. Thompson, Jr., B. F. Perkins & Son, Inc., Holyoke, Mass.
D. M. Wadsworth, Gaylord Container Corp., Bogulusa, La.
Clarence J. West, Institute of Paper Chemistry, Appleton, Wis.
Robert Wynne-Roberts, Finch, Pruyn & Co., Inc., Glens Falls, N. Y.

Meetings of the Association

In addition to the Annual Meeting there were held eight functional conferences. The details of the conferences were published in several issues of *Tappi*.

1953 Annual Meeting

The Annual Meeting of the Association was held at the Commodore Hotel, New York, N. Y., on Feb. 16–19, 1953. More than 1900 individuals registered and 95 papers were presented. The annual luncheon was featured by an address by Allen Abrams, vice-president in charge of research of the Marathon Corp., Rothschild, Wis., who talked on "The Progress of Research in the Pulp and Paper Industry." The TAPPI Medal was presented to Roger C. Griffin, retired, by James d'A. Clark on behalf of the Technical Association. Because of ill health Mr. Griffin was represented by his son Roger Griffin, Jr. The citation specified Mr. Griffin's contribution to the advancement of testing procedures relating to the pulp and paper industry.

Fourth Coating Conference

The Coating Committee sponsored the fourth in its series of annual conferences at the Netherland Plaza Hotel, Cincinnati, Ohio, on May 25–27, 1953. The conference featured symposia on "Coated Paper in Offset Printing" and "Coated Board." J. H. Heuer, Great Northern Paper Co., Millinocket, Me., was general chairman of the conference. R. T. Trelfa, Watervliet Paper Co., Watervliet, Mich., was program chairman. A. C. Zettlemoyer, National Printing Ink Research Institute, Lehigh University, Bethlehem, Pa., and J. T. Loomer, Robert Gair Co., Uncasville, Conn., were chairmen of the symposia. Arrangements for the meeting were taken care of by the TAPPI Ohio Section, C. E. Brandon, Howard Paper Mills, Dayton, Ohio, chairman. George B. Gregg, Cincinnati Gas & Electric Co., Cincinnati, Ohio, was chairman of the Local Arrangements Committee. Reuben B. Robertson, Jr., president of the Champion Paper & Fibre Co., Hamilton, Ohio, was the luncheon speaker and related his observation made on a recent tour of Western Germany. Inspection tours were made of the plants of the Mead Corp., Chillicothe, Ohio, Gardner Board & Carton Co., Lockland, Ohio, and the U. S. Printing & Lithograph Co., Norwood, Ohio. There were 343 individuals registered.

Second Statistics Conference

The Statistics Committee, John Langmaid, Jr., S. D. Warren Co., Cumberland Mills, Me., chairman, sponsored a two-week conference on "The Application of Statistical Methods" at Western Michigan College, Kalamazoo, Mich., on June 15–26, 1953. The workshop and lecture sessions were conducted under the direction of Professors Charles Butler and Fred Beeler of Western Michigan College, Professor Geoffrey Beale of the University of Connecticut, Storrs, Conn., and Charles A. Bicking of the U. S. Army Ordnance Corps., Washington, D. C. Fifty-one individuals attended the conference.

Ninth Paper-Plastics Conference

The Ninth Paper-Plastics Conference was held in the Baker Auditorium, College of Forestry, State University of New York, Syracuse, N. Y., on Sept. 15–16, 1953. Ralph T. Nazzaro, Westfield River Paper Co., Russell, Mass., was chairman of the TAPPI Plastics Committee which sponsored the meeting. The program featured "Fundamental Concepts," "Special Resins," and "Plasticizers." Professor Herman Mark, Polytechnic Institute of Brooklyn, Brooklyn, N. Y., and J. C. Pullman, American Cyanamid Co., Stamford, Conn., were chairmen of the meeting sessions. About 150 individuals were registered.

Third Testing Conference

The Third Testing Conference was held at the Battelle Memorial Institute, Columbus, Ohio, on Sept. 22–23, 1953. This was a workshop type of meeting participated in by the TAPPI Paper Testing Committee and the Joint TAPPI-ASTM Committee on Petroleum Wax. Consideration was given to TAPPI Standards in process of development and revision. Samuel A. Woodruff of the Battelle Memorial Institute handled local arrangements and conducted the tour of the Institute facilities. W. J. Yates of Shell Oil Co., New York, N. Y., handled the program of the Wax Testing Committee and D. H. Newcomb, Riegel Paper Corp., Riegelsville, N. J., presided as chairman of the Paper Testing Committee. About 90 individuals attended the conference.

Tenth Fibrous Agricultural Residues Conference

The Tenth Fibrous Agricultural Residues Conference was held at the Quinte Hotel, Belleville, Ont., on Oct. 8–9, 1953. S. I. Aronovsky of the Northern Regional Research Laboratory, Peoria, Ill., presided as general chairman of the conference. W. H. Palm, vice-president of Hinde & Dauch Co. of Canada, Ltd., Toronto, Ont., was chairman of the Local Arrangements Committee. The technical program was devoted to a consideration of the crush test. Featured speakers included L. R. Thiesmeyer of the Pulp and Paper Research Institute of Canada, Montreal, P. Q., whose subject was "Peanuts and Progress," and R. G. Macdonald, Secretary-Treasurer of the Technical Association of the Pulp and Paper Industry, New York, N. Y., who gave a talk on "TAPPI and the Strawboard Industry." An inspection tour was made at the mill of Hinde & Dauch of Canada, Ltd. at Trenton, Ont., where special interest centered in the use of the new Va-Purge Process. About 40 individuals attended the conference.

Third Corrugated Containers Conference

The Third Corrugated Containers Conference was held at the Statler Hotel, New York, N. Y., on Oct. 15–16, 1953. The meeting was sponsored by the Corrugated Containers Committee, Burt Mendlin, Cornell Paperboard Products Co., Milwaukee, Wis., chairman. Keith W. Max of the Robert Gair Co., New York, N. Y., was general chairman of the conference. The chairmen of the technical section were E. A. Taub, Gibraltar Corrugated Paper Co., North Bergen, N. J., and W. W. Fitzhugh, Jr., Wm. W. Fitzhugh, Inc., Brooklyn, N. Y. The meeting was featured by visits to the corrugated container plants of the Allcraft Container Corp., Harrison, N. J., Gibraltar Corrugated Paper Co., North Bergen, N. J., and Robert Gair Co., Teterboro, N. J. About 200 individuals attended the conference. The technical programs featured "Printing on Corrugated Containers."

Eighth Engineering Conference

The Eighth Engineering Conference was held at the Sheraton-Mt. Royal Hotel, Montreal, P. Q., on Oct. 26–29, 1953. C. J. Sibler of the West Virginia Pulp & Paper Co. was general chairman of the conference. W. C. Bloomquist of the General Electric Co., Schenectady, N. Y., was general secretary. The total registration was 525 individuals. A. T. Hurter of Stad-

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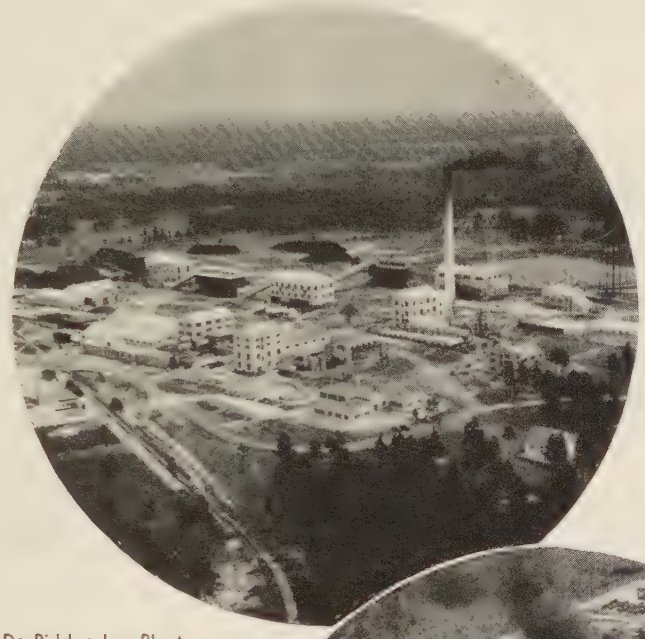
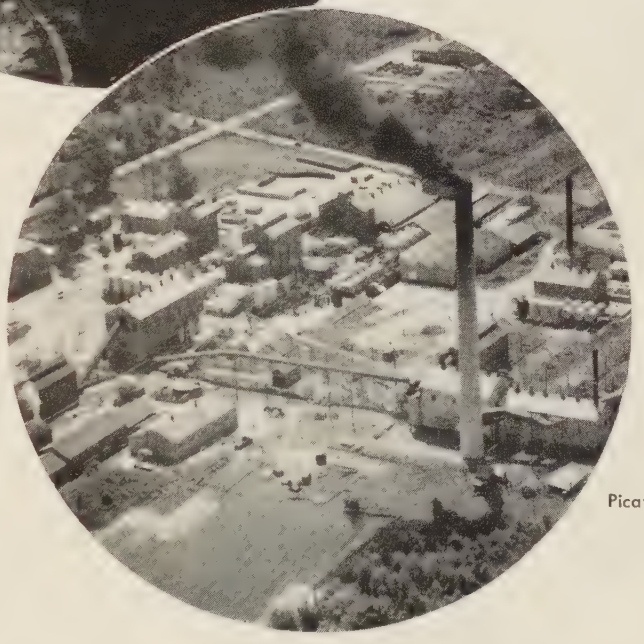


De Ridder, La., Plant



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ler, Hurter & Co., Montreal, P. Q., was chairman of the Local Arrangements Committee.

The technical program was sponsored by the committees of the divisions: Mill Maintenance and Materials Committee, H. F. Parker, New York & Pennsylvania Co., Lock Haven, Pa., chairman; Materials Handling Committee, A. P. Schnyder, Ebasco Services, Inc., chairman; Drying and Ventilating Committee, Curt A. Young, Riegel Paper Corp., Milford, N. J., chairman; Steam and Power Committee, W. M. Wyburn, Federal Paper Board Co., Inc., Bogota, N. J., chairman; Mill Design and Economic Aspects Committee, R. A. Packard, consulting engineer, Takoma Park, Md., chairman; Chemical Engineering Committee, J. R. Lientz, Union Bag & Paper Corp., chairman; Digester Corrosion Subcommittee, Nicholas Shoumatoff, West Virginia Pulp & Paper Co., New York, N. Y., chairman; Electrical Engineering Committee, R. W. Foster, Champion Paper & Fibre Co., Canton, N. C., chairman; Hydraulics Committee, K. J. Mackenzie, Eastman Kodak Co., Rochester, N. Y., chairman; and Engineering Research and Machine Design Committee, J. D. Lyall, Armstrong Cork Co., Lancaster, Pa., chairman. Douglas A. Ambridge, president of the Abitibi Power & Paper Co., Toronto, Ont., was the luncheon speaker. His subject was "The Urgent Needs of Industry." The banquet speaker was B. K. Sandwell, former Editor of *Toronto Saturday-Night*. Following the conference an inspection tour was made of the plants of the Dominion Engineering Works, Ltd., and Dominion Bridge Co., Ltd., Lachine, P. Q.

Seventh Alkaline Pulping Conference

The Seventh Alkaline Pulping Conference was held at the Rice Hotel, Houston, Tex., on Nov. 18–20, 1953. Fred W. Bishop of Southland Paper Mills, Lufkin, Tex., was general chairman of the conference. There were 282 men and 53 ladies registered at the conference. I. D. Wells of the Champion Paper & Fibre Co., Pasadena, Tex., was chairman of the local committee. Kenneth D. Running of the Halifax Paper Co., Roanoke Rapids, N. C., was chairman of the Program Committee.

The technical program was devoted to "Pulp Washing and Screening" and to "Semichemical Pulping." The moderators were Fred Bishop, K. D. Running, M. B. Pineo, Brunswick Pulp & Paper Co., Brunswick, Ga., and J. N. McGovern, Forest Products Laboratory, Madison, Wis.

Inspection tours were made of the mills of the Champion Paper & Fibre Co., Pasadena, Tex., and the Southland Paper Mills, Lufkin, Tex. The luncheon speaker was Karl R. Bendetsen, assistant division manager of the Pasadena, Tex., Division of the Champion Paper & Fibre Co. and former Undersecretary of the Army. His subject was "What Is Public Relations?" W. L. McHale, vice-president of Southland Paper Mills, presided as toastmaster.

Publications of the Association

Tappi

Tappi, the monthly magazine of the Association, completed its fifth successful year in December, 1953. There were many individuals, including staff members of trade journals serving the industry, that expressed the opinion that such a high-quality publication could not keep going for more than a year or two. Insofar as the foreseeable future is concerned, it appears likely that *Tappi* will serve the industry well for many years to come. The quality of its text material has attracted a large number of contributors and, of course, has met a real need throughout the pulp and paper industry.

Bibliography of Paper Making

The annual TAPPI Bibliographies of Paper Making have made an outstanding contribution to the progress of the pulp and paper industry. They provide a record of nearly every book and article published on the subject of pulp and paper since 1900. Until the end of last year the compilation of this remarkable publication was made by Clarence J. West who died in January, 1953, following a lifetime that was fruitful in its service to his fellow men. Although Dr. West continued to work on the preparation of the Bibliography of Paper Making for 1952 there were many details that he was unable to complete. The Association is therefore in debt to the members of the staff of The Institute of Paper Chemistry who brought the work to completion so that it could finally be issued in 1954. The members of the Institute staff are continuing this work toward the preparation of future bibliographies. The writer cannot express adequately his great personal loss of the association and friendship of Dr. West. When the writer first met Dr. West in 1927 the latter was abstracting technical articles for the Technical Association and it is believed that he was continuing this practice nearly to the end of his industrious life.

TAPPI Standards

During 1953 there were nine new standards and suggested methods approved: T 231 sm-53 Zero-Span Breaking Length of Pulp; T 232 sm-53 Fiber Length and Coarseness of Pulp by Projection; T 233 sm-53 Fiber Length of Pulp by Classification; T 482 m-52 Water Vapor Permeability of Sheet Materials at 0°F.; T 483 sm-53 Odor of Packaging Materials; T 484 m-53 Moisture in Paper by Toluene Distillation; T 485 m-53 Pinholes in Glassine and Greaseproof Papers; T 486 sm-53 Blood Resistance of Butchers' Wrapping Paper; T 637 sm-53 Viscosity of Starch and Starch Products. A report of the Standards Committee will be published in the March, 1954, issue of *Tappi*.

Monographs

TAPPI Monograph No. 10 on "Bleaching of Pulp" was published and issued in 1953. This monograph was sponsored by the TAPPI Pulp Purification Committee under the chairmanship of Ward D. Harrison, Riegel Paper Corp., Milford, N. J.

TAPPI Medal Award

The 1953 TAPPI Medal was awarded to Roger C. Griffin of Needham, Mass., chairman of the TAPPI Standards Committee.

Employment

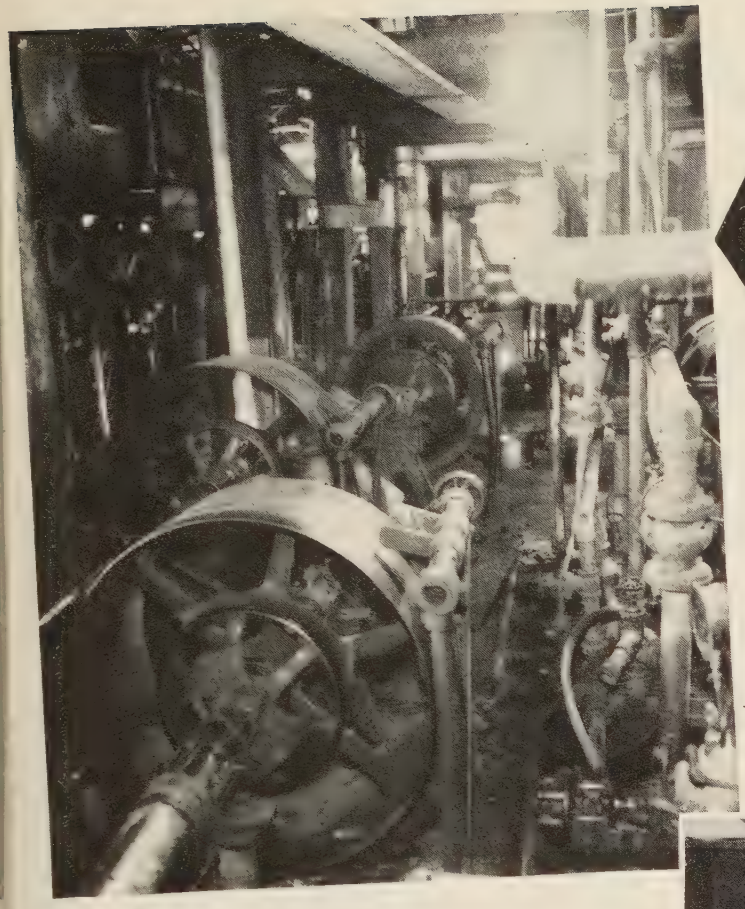
The TAPPI Employment Service which has always been a good barometer of employment of technically trained men in the industry was slightly more active in 1953 than in 1952. Eighty-seven positions open were advertised in *Tappi* as compared to seventy-three in 1952. Sixty-one positions wanted were advertised in 1953 as compared to fifty-four in 1952. The shortage of technically trained men graduating from college continues and is expected to do so for several years in the future. The Association is always pleased to have an opportunity to help companies find qualified employees and to assist men in finding suitable positions in the industry.

Research Projects

During 1953 the Association made research grants of $31,275, not including some grants made late in the year and actually paid in 1954. These grants were made to finance research projects sponsored by the committees of the Association. A sum of $40,000 was appropriated for this purpose at the 1953 Annual Meeting. A record of the research projects in process and a tabulation of all of the grants made by the Association were published in the September and October, 1953, issues of *Tappi*.

Local Sections

No new sections were chartered in 1953.



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The chairmen of the local sections elected in 1953 were as follows:

Pacific—F. J. Weleber, Publishers Paper Co., Oregon City, Ore.
Lake States—Robert J. Seidl, Forest Products Laboratory, Madison, Wis.
Delaware Valley—F. J. Lovegren, P. H. Glatfelter Co., Spring Grove, Pa.
Kalamazoo Valley—R. H. Hurst, Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich.
New England—F. S. Klein, Byron Weston Co., Dalton, Mass.
Ohio—J. L. Clouse, Oxford Miami Paper Co., West Carrollton, Ohio
Empire State—D. Chace Mather, Carthage Paper Makers, Inc., Carthage, N. Y.
Maine-New Hampshire—Joseph J. Thomas, S. D. Warren Co., Cumberland Mills, Me.
Chicago—Edward C. Berg, Ace Carton Co., Chicago, Ill.
Lake Erie—R. L. Lewis, Ohio Boxboard Co., Rittman, Ohio
Southeastern—Malcolm B. Pineo, Brunswick Pulp & Paper Co., Brunswick, Ga.
Papermakers & Associates of Southern California (Unaffiliated)—T. S. Markov, Vernon Div., Fiberboard Products, Inc., Los Angeles, Calif.

Divisions and Committees

The divisions and committees of the Association were very active in 1953. Most of the committees devoted some time to continuing projects which, in some cases, included Association-financed research projects. In addition to participating in the program of the Annual Meeting several committees sponsored well-attended conferences in the Spring and the Fall. The activities of the committees have been reported in the monthly issues of *Tappi*. The following information relates, for the record, to details concerning chairmen who have served during the year:

Engineering Division: C. J. Sibler, West Virginia Pulp & Paper Co., New York, N. Y., general chairman, and Walter C. Bloomquist, General Electric Co., Schenectady, N. Y., general secretary. John D. Lyall, Armstrong Cork Co., Lancaster, Pa., was appointed assistant general chairman. *Steam and Power Committee:* Wilfred N. Wyburn, Federal Paper Board Co., Inc., Bogota, N. J., chairman. *Materials Handling Committee:* W. R. McNally, Link-Belt Co., Chicago, Ill., succeeded A. P. Schnyder, Ebasco Services, Inc., New York, N. Y., as chairman. *Drying and Ventilating Committee:* Curt A. Young, Riegel Paper Corp., Milford, N. J., chairman. *Engineering Research and Machine Design Committee:* R. G. Quinn, Johns-Manville Corp., Manville, N. J., succeeded John D. Lyall as chairman. This committee has three subcommittees. *Centralized Control of Stock Systems Subcommittee:* Lester J. Tarbell, Bird & Son, Inc., East Walpole, Mass., chairman. *Correlation of Various Types of Plastometers Subcommittee:* K. W. Brenner, Eastman Kodak Co., Rochester, N. Y., chairman. *Machine Design Data Subcommittee:* George E. Clink, Sandy Hill Iron & Brass Works, Hudson Falls, N. Y., chairman. *Mill Planning and Economics Committee* (formerly Mill Design and Economic Aspects Committee): R. A. Packard, Takoma, Park, Md., chairman. This committee has two subcommittees. *Mill Location, Design, and Construction Subcommittee:* M. C. Celli, Celli-Flynn, McKeesport, Pa., chairman, and *Processes, Utilities and Mill Operations Subcommittee:* S. H. Grimnes, Diamond Match Co., Plattsburg, N. Y., chairman. *Hydraulics Committee:* K. J. Mackenzie, Eastman Kodak Co., Rochester, N. Y., chairman. *Mill Maintenance and Materials Committee:* George F. Hrubecky, Marathon Corp., Menasha, Wis., succeeded H. F. Parker, New York & Pennsylvania Co., Lock Haven, Pa., as chairman. *Electrical Engineering Committee:* Ray W. Foster, Champion Paper & Fibre Co., Canton, N. C., chairman. This committee has four subcommittees. *Motor Characteristics Subcommittee* and *Downtime on Electrical Sectional Drive Subcommittee:* R. F. Sorenson, Union Bag & Paper Corp., Savannah, Ga., chairman. *Cable Subcommittee:* A. E. Mortenson, St. Regis Paper Co., Pensacola, Fla., chairman. *Chipper Drive Subcommittee:* M. J. Osborne, Bowaters Southern Paper Corp., Calhoun, Tenn., chairman. *Chemical Engineering Committee:* J. R. Lientz, Union Bag & Paper Corp., Savannah, Ga., chairman. *Digester Corrrosion Subcommittee:* Nicholas Shoumatoff, West Virginia Pulp & Paper Co., New York, N. Y., chairman. *Data Sheets Committee:* J. W. Hemphill, Johns-Manville Corp., New York, N. Y., succeeded Henry J. Perry, Waste Paper Utilization Council, New York, N. Y., as chairman.

Research Development Division: W. F. Holzer, Crown Zellerbach Corp., San Francisco, Calif., general chairman. *Bibliography Committee:* No chairman appointed to succeed C. J. West (deceased). *Fundamental Research Committee:* Harry F. Lewis, Institute of Paper Chemistry, Appleton, Wis., chairman. *Statistics Committee:* John F. Langmaid, Jr., S. D. Warren Co., Cumberland Mills, Me., chairman. *Microbiological Committee:* B. F. Shema, Institute of Paper Chemistry, Appleton, Wis., succeeded R. F. DeLong, Marathon Corp., Rothschild, Wis., as chairman. *Testing of Mildew Resistance Subcommittee:* B. F. Shema, chairman, *Microbiological Monograph Subcommittee:* J. W. Appling, Buckman Laboratories, Memphis, Tenn., chairman. *Patents Committee:* Frank Makara, Patent Attorney, New York, N. Y., chairman.

Industrial Division: Norman I. Bearse, Champion International Co., Lawrence, Mass., succeeded R. W. Kumler, American Cyanamid Co., as general chairman. *Training and Education Committee:* J. H. Groves, Union Bag & Paper Corp. Savannah, Ga., resigned in August as chairman. No chairman has been appointed to succeed him. *Cost Engineering Committee:* A. E. Bachmann, Missisquoi Corp., Sheldon Springs, Vt., chairman. *Nonfibrous Raw Materials Committee:* E. N. Poor, Hudson Pulp & Paper Co., Augusta, Me., chairman. *Mill Instrument Control Committee:* no chairman. *Water Committee:* A. S. Erspamer, Hollingsworth & Whitney Co., Waterville, Me., chairman. There are four subcommittees. *Analytical and Testing Methods Subcommittee:* W. A. Tanzola, W. H. and L. D. Betz, chairman. *Special Projects Subcommittee:* E. N. Poor, chairman. *Water Supply and Treatment Subcommittee:* H. J. Skinner, Boston, Mass., chairman. *White Water Utilization and Waste Disposal Subcommittee:* C. C. Porter, Southland Paper Mills, Lufkin, Tex., chairman. *Fibrous Agricultural Residues Committee:* S. I. Aronovsky, Northern Regional Research Laboratory, Peoria, Ill., chairman. There are five subcommittees. *Procurement, Storage, and Preservation Subcommittee:* H. M. Blandin, Central Fibre Products Co., Quincy, Ill., chairman. *Raw Materials Classification Subcommittee:* S. I. Aronovsky, chairman. *Pulping Subcommittee:* J. R. Little, Hinde & Dauch Paper Co., Sandusky, Ohio, chairman. *Board and Paper Manufacture Subcommittee:* M. F. Knack, River Raisin Paper Co., Monroe, Mich., chairman. *Testing Subcommittee:* W. L. Cassiday, Alton Boxboard Co., Alton, Ill., chairman. *Structural Fibrous Materials Committee:* E. M. Jenkins, Johns-Manville Research Center, Manville, N. J., chairman. There are ten subcommittees. *New Projects and Review Subcommittee:* J. O. Burton, Minnesota & Ontario Paper Co., International Falls, Minn., chairman. *Paper Publication and Review Subcommittee:* J. F. Campbell, Flintkote Co., Meridian, Miss., chairman. *Test Board Formation Subcommittee:* R. G. Lacey, Celotex Co., Marrero, La., chairman. *Drainage Time Testing Subcommittee:* J. J. Perot, Flintkote Co., Whippany, N. J., chairman. *Transverse and Deflection Testing Subcommittee:* J. F. Campbell, chairman. *Water Absorption, Water Penetration and Water Vapor Permeability Subcommittee:* A. T. Walton, Simpson Logging Co., Shelton, Wash., chairman. *Nail Holding and Racking Test Subcommittee:* T. C. Duval, Wood Conversion Co., Cloquet, Minn., chairman. *Light Reflection Measurement Subcommittee:* W. L. Scott, Armstrong Cork Co., Lancaster, Pa., chairman. *Consistency*

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Combustion Chamber and Absorption Tower Linings
Digester Linings
Bleach Plant Tanks and Linings
Pulp Storage Chests

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Acid and Alkali Storage Tanks
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Measurements of Insulating Board Pulps Subcommittee: A. H. Chamberlain, Bird & Son, East Walpole, Mass., chairman. *Test Board and Hand Sheets for Board Pulp Evaluation Subcommittee:* C. K. Textor, The Bauer Bros. Co., Springfield, Ohio, chairman.

Converting and Consuming Division: L. K. Burnett, Ohio Boxboard Co., Rittman, Ohio, general chairman. *Corrugated Containers Committee:* Burt Mendlin, Cornell Paperboard Products, Inc., Milwaukee, Wis., succeeded F. D. Long, Container Corp. of America, Chicago, Ill., as chairman. There are nine subcommittees. *Adhesives Subcommittee:* Burt Mendlin, chairman. *Taping Subcommittee:* R. A. Purdy, International Paper Co., Somerville, Mass., chairman. *Stitching Subcommittee:* W. W. Marteny, National Container Corp., Tomahawk, Wis., chairman. *Waste Subcommittee:* Keith Max, Robert Gair Co., New York, N. Y., chairman. *Printing Subcommittee:* D. P. McNelly, Fort Wayne Corrugated Paper Co., Rochester, N. Y., chairman. *Corrugator Roll Wear Subcommittee:* G. G. Johnston, Waldorf Paper Products Co., St. Paul, Minn., chairman. *Finger Lines Subcommittee:* W. K. Tobin, American Box Board Co., Grand Rapids, Mich., chairman. *High and Low Corrugations Subcommittee:* J. J. Koenig, Gaylord Container Corp., St. Louis, Mo., chairman. *Heat and Moisture Control Subcommittee:* H. T. Scorda, Union Bag & Paper Corp., Savannah, Ga., chairman. *Container Evaluation and Development Committee:* C. H. Krebs, Atlas Boxmakers, Inc., chairman. *Graphic Arts Committee:* C. H. Morton, West Virginia Pulp & Paper Co., Chicago, Ill., succeeded F. D. Elliott, Time, Inc., Springdale, Conn., as chairman. *Coating Committee:* R. T. Trelfa, Watervliet Paper Co., Watervliet, Mich., succeeded J. H. Heuer, Great Northern Paper Co., Millinocket, Me., as chairman. There are ten subcommittees. *Research Subcommittee:* N. F. Kennedy, Corn Industries Research Foundation, New York, N. Y., chairman. *Wax Subcommittee:* J. D. Clark, D. L. Ward Co., Philadelphia, Pa., chairman. *Mechanical Equipment Subcommittee:* F. W. Egan, Frank W. Egan Co., Bound Brook, N. J., chairman. *Laminating Subcommittee:* J. E. Fenn, consultant, New York, N. Y., chairman. *Literature Review Subcommittee:* C. G. Landes, American Cyanamid Co., Stamford, Conn., chairman. *Waxed Paper Subcommittee:* L. M. Perry, Nashua Gummed Paper Co., Nashua, N. H., chairman. *Gummed Papers Subcommittee:* J. E. Sullivan, McLaurin-Jones Co., Brookfield, Mass., chairman. *Raw Stock Subcommittee:* H. O. Ware, Hercules Powder Co., Wilmington, Del., chairman. *Pigments Subcommittee:* W. R. Willets, Titanium Pigment Corp., New York, N. Y., chairman. *Testing Procedures Subcommittee:* Miss L. V. Hans, U. S. Quartermaster Corps., Philadelphia, Pa., chairman. *Wet Strength Committee:* K. W. Britt, Scott Paper Co., Chester, Pa., chairman. *Plastics Committee:* R. T. Nazzaro, Westfield River Paper Co., Russell, Mass., succeeded E. C. Jahn, New York State College of Forestry, Syracuse, N. Y., as chairman. There are three subcommittees. *Fabrication and Structural Products Subcommittee:* C. J. Straka, Micarta Div., Westinghouse Electric Corp., Trafford, Pa., chairman. *Plastics in Paper Converting Subcommittee:* R. T. Nazzaro, chairman. *Resin Analysis Subcommittee:* S. E. Church, New York State College of Forestry, Syracuse, N. Y., chairman.

Pulp Manufacture Division: G. A. Day, Brown Co., Berlin, N. H., succeeded K. O. Elderkin, Bowaters Southern Paper Corp., Calhoun, Tenn., as general chairman. *Acid Pulping Committee:* E. H. Woodruff, Rayonier, Inc., Port Angeles, Wash., chairman. *Alkaline Pulping Committee:* F. W. Bishop, Southland Paper Mills, Lufkin, Tex., succeeded R. R. Fuller, Gulf States Paper Co., Tuscaloosa, Ala., as chairman. *Semichemical Pulping Committee:* J. N. McGovern, Forest Products Laboratory, Madison, Wis., chairman. *Mechanical Pulping Committee:* F. W. O'Neil, New York State College of Forestry, Syracuse, N. Y., chairman. *Chemical Products Committee:* Arthur Pollak, consultant, New York, N. Y., chairman. *Paper Deinking Committee:* J. J. Forsythe, International Paper Co., Niagara Falls, N. Y., chairman. *Pulp Purification Committee:* W. Howard Rapson, University of Toronto, Toronto, Ont., succeeded R. L. McEwen, Buffalo Electro-Chemical Corp., Buffalo, N. Y., as chairman. *Pulps for Chemical Conversion Committee:* F. A. Simmonds, Forest Products Laboratory, Madison, Wis., chairman.

Paper Manufacture Division: R. P. Price, Hammermill Paper Co., Erie, Pa., general chairman. *Preparation of Papermaking Materials Committee:* F. S. Klein, Byron Weston Co., Dalton, Mass., chairman. There are two subcommittees. *Fillers Monograph Subcommittee:* R. J. Proctor, West Jersey Paper Co., Camden, N. J., chairman. *Significance of Sizing Tests Subcommittee:* R. G. Mispley, Crown Zellerbach Corp., Camas, Wash., chairman. *Paper Making (Cylinder) Committee:* G. T. Renegar, Container Corp. of America, Manayunk, Pa., succeeded J. J. Harrison, Michigan Carton Co., Battle Creek, Mich., as chairman. *Paper Making (Fourdrinier) Committee:* N. R. Phillips, Champion Paper & Fibre Co., Canton, N. C., chairman. *Tissue Subcommittee:* L. P. Thompson, Personal Products Corp., Milltown, N. J., chairman.

Testing Division: J. P. Casey, A. E. Staley Mfg. Co., Decatur, Ill., succeeded J. d'A. Clark, consultant, Longview, Wash., as general chairman. *Fibrous Materials Testing Committee:* James R. Lyon, Atlas Boxmakers, Inc., Chicago, Ill., succeeded J. P. Casey as chairman. There are seven subcommittees. *Testing of Enzymes Subcommittee:* Alexander Frieden, Pabst Research Laboratories, Milwaukee, Wis., chairman. *Testing of Rosin and Rosin Size Subcommittee:* D. D. Cameron, Hercules Powder Co., Wilmington, Del., chairman. *Testing of Clays Subcommittee:* C. G. Albert, Edgar Bros. Co., McIntyre, Ga., chairman. *Testing of Casein Subcommittee:* D. B. Laird, The Borden Co., Bainbridge, N. Y., chairman. *Testing of Coating Starches Subcommittee:* C. C. Kesler, Penick & Ford, Ltd., Cedar Rapids, Iowa, chairman. *Testing of Titanium Dioxide Subcommittee:* W. R. Willets, Titanium Pigment Co., New York, N. Y., chairman. *Testing of Calcium Sulphate Subcommittee:* John Lewis, Lowell Technological Institute, Lowell, Mass., chairman. *Wax Testing:* A. M Heald, Scott Paper Co., Chester, Pa., chairman. *Pulp Testing Committee:* F. E. Caskey, Crown Zellerbach Corp., Camas, Wash., succeeded R. I. Thieme, Scott Paper Co., Everett, Wash., as chairman. *Optical Properties Committee:* H. E. Obermanns, Hammermill Paper Co., Erie, Pa., chairman. *Microscopy Committee:* C. E. Brandon, Howard Paper Mills, Dayton, Ohio, chairman. *Paper Testing Committee:* D. H. Newcomb, Riegel Paper Co., Riegelsville, N. J., chairman. *Container Testing Committee:* A. V. Grundy, Quartermaster Food and Container Institute, Chicago, Ill., chairman. *Packaging Materials Testing Committee:* W. H. Aiken, Gardner Board & Carton Co., Middletown, Ohio, succeeded L. E. Simerl, Olin Industries, Inc., New Haven, Conn., as chairman. There are four subcommittees. *Water Vapor Permeability Subcommittee:* T. E. Dobbins, American Can Co., Maywood, Ill., succeeded Charles A. Southwick, Jr., H. P. Smith Paper Co., Chicago, Ill., as chairman. *W.V.P. of Completed Packages Subcommittee:* C. M. Woodcock, General Foods Corp., Hoboken, N. J., chairman. *Insect Resistance of Packages, Paper and Paperboard Subcommittee:* H. S. Gardner, Fibreboard Products, Inc., Antioch, Calif., chairman. *Flavor and Odor Transfer Subcommittee:* A. H. Landrock, Dept. of Food Technology, Massachusetts Institute of Technology, Cambridge, Mass., chairman. *Chemical Methods Committee:* A. S. O'Brien, Eastman Kodak Co., Rochester, N. Y., chairman. There are three subcommittees. *Alpha, Beta, Gamma Cellulose Subcommittee:* A. S. O'Brien, chairman. *Disperse Viscosity Subcommittee:* A. F. Martin, Virginia Cellulose Div.,

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The 39th Annual Luncheon of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 18, 1954

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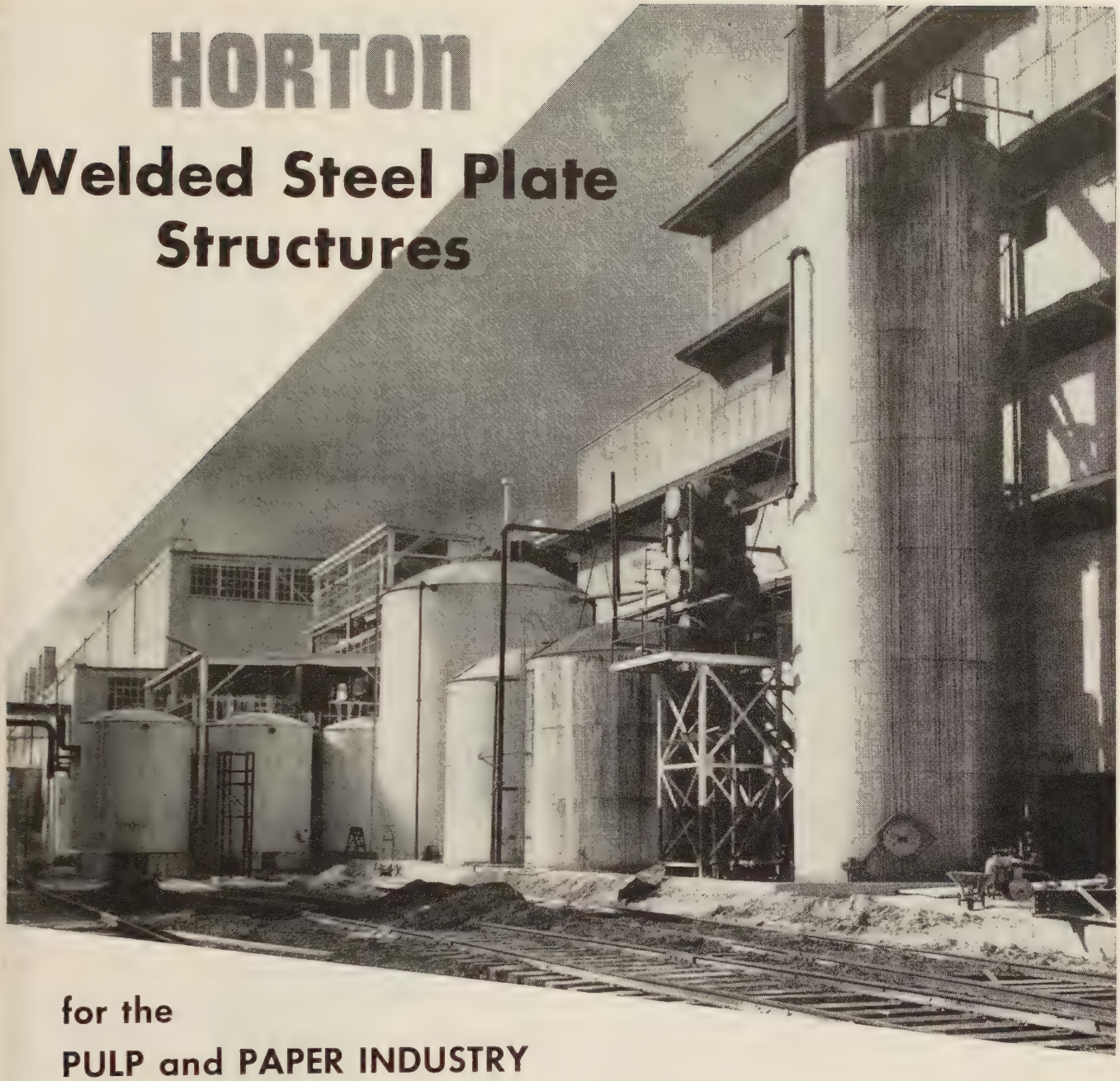

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Hercules Powder Co., Wilmington, Del., chairman. *Reducible Sulphur in Paper and Pulp Subcommittee:* C. P. Donofrio, Nekoosa-Edwards Paper Co., Port Edwards, Wis., chairman. *Moisture in Cellulose Subcommittee:* Geoffrey Broughton, University of Rochester, Rochester, N. Y., chairman.

Special Committees: *Standards Committee:* R. C. Griffin, Needham, Mass., chairman. *Research Appropriations Committee:* John L. Parsons, Waterville, Me., chairman. *Joint Textbook Committee:* Harry S. Spencer, Howard Smith Paper Mills, Beauharnois, Que., chairman. This committee is responsible for the preparation of the industry's textbooks on "Pulp and Paper Manufacture." The other members of the committee are R. S. Hatch, Hudson Pulp & Paper Co., Palatka, Fla., R. G. Macdonald, TAPPI, Douglas Jones, CPPA Technical Section, and R. S. Kellogg, Bradenton, Fla. J. N. Stephenson, *Pulp and Paper Magazine of Canada,* Gardenvale, Que., is Editor.

Association Staff Increase

In July, 1953, the headquarters staff of the Technical Association was increased by the employment of A. John Winchester, formerly of the Donnacona Paper Co., Donnacona, Que. Mr. Winchester will devote most of his time to assisting the divisions and committees of the Association.

R. G. Macdonald, *Secretary, TAPPI*

1954 TAPPI Medal to G. W. E. Nicholson

The twenty-second TAPPI medal was presented to Gunnar W. E. Nicholson, executive vice-president of the Union Bag & Paper Corp., New York, N. Y., at the annual luncheon of the Technical Association of the Pulp and Paper Industry held at the Commodore Hotel, New York City, on Thursday, Feb. 18, 1954.

K. O. Elderkin of Bowaters Southern Paper Corp., Calhoun, Tenn., and vice-president of the Association made the presentation on behalf of the Executive Committee of the Association. The remarks of Mr. Elderkin and Mr. Nicholson follow:

Presentation Remarks by K. O. Elderkin

I am grateful for the privilege of representing the membership of TAPPI in presenting its award for distinguished service, the TAPPI Medal, to one of my best friends, Gunnar Nicholson. It isn't often that one has the privilege of telling the world, so to speak, of all the good qualities of one of his best friends and I certainly appreciate the opportunity.

G. W. E. Nicholson was born in Sweden. He graduated in Chemical Engineering from the Chalmers Institute of Technology in Gothenburg. In 1921 he left Sweden and came to the United States. Young Gunnar had very carefully planned his future and was going to spend a few months working in each of several mills in Canada and the United States for a period of 2 years, after which he planned to return to Sweden and make his fortune. Nobody knows why Gunnar did not return to Sweden but he is still with us, and as a matter of fact it was 25 years before he got back to Sweden for even a visit.

The 2 years' sojourn in the New World was finally interrupted 25 years later when Gunnar Nicholson was included in a group of industry representatives sent by the Government of the United States in 1946 upon the request of the governments of the Scandinavian countries to study research, education, and industry in the three Scandinavian countries for the purpose of extending good-will and interchanging information. This group included the foremost leaders in industry, education, and research in this country, and it was a high honor to be included in this group.

Gunnar married Lillian Greenough in 1928 in Montreal. My own observation is that Lillian has in her own quiet way contributed a great deal toward Gunnar's success.

His first job in this country was paper mill superintendent at the Poland Paper Co. at Mechanics Falls, Me., which I think has since disappeared from the picture. From Mechanics Falls in 1923, Gunnar went to the old Riordon Mill at Temiskaming, which is now part of International Paper Co. He spent some time at the Canada Paper Co. and the Howard Smith Paper Co., and in 1926, went to Bogalusa, La., as general superintendent of the mill which is now part of the Gaylord Container Corp. In 1931 he was made manager of mills for the Southern Kraft Corp., and in 1941 he became resident manager of the Union Bag & Paper Corp. at Savannah. He is still with Union Bag & Paper Corp. but is now executive vice-president in charge of their operations, which as you know include the largest papermaking and converting plant in the world and numerous converting plants.

This medal is intended to be presented to those whose achievements have definitely contributed to the technical progress of the pulp and paper and paperboard industry. I think we can show that the gentleman here has been outstanding in this way.

Gunnar joined TAPPI in 1925, became its vice-president in 1944–45, and its president in 1946. He has been very active in the affairs of this Association and has contributed a tremendous amount of his time and energy to its activities.

He was very active in the formation of the Alkaline Pulping Division and the annual conference which it now holds. He was largely responsible for the organization of the Engineering Division which now holds an annual conference and which, in point of attendance, is now the largest meeting of TAPPI outside of the Annual Meeting, which is an evidence of the interest generated in that division.

Gunnar was directly responsible for the promotion and organization of the Southeastern Section of TAPPI which is now an active going concern.

The Corrugated Container Committee was formed largely through his efforts and he was responsible for the organizing of the Digester Corrosion Committee which has been so active during the past 3 years and which has done such excellent work.

Gunnar contributed a tremendous amount of time in helping to work out a pension plan for the members of the TAPPI staff in New York and the pension plan which has been worked out is, I believe, a very satisfactory one to all concerned.

Gunnar has been willing at all times through the years to take on jobs for TAPPI and to see them through to a conclusion.

The influence of this man has been felt all through the South and East. He has been one of the leaders in most of the worth-while projects which have been undertaken in this area.

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K. O. Elderkin presenting the TAPPI Medal to G. W. E. Nicholson

I think Gunnar's greatest achievement, however, has been in the field of management. His work at Union Bag speaks for itself. There we have one of the finest manufacturing organizations in the paper industry and this organization has been built up largely through the efforts of Mr. Nicholson.

Gunnar has always taken a keen interest in young technical men and I think one of his finest contributions to the industry is in the training of young men. He has helped them with their college training, has given them a start in the industry, and has guided them through their early years and brought them up to maturity. I think there are a great many young men in this audience, and many others besides, who will gladly tell you that they owe a great deal to Gunnar Nicholson for his help and guidance in steering their careers through the years.

TAPPI is not the only organization which has recognized and honored this man. He has been made an honorary member of the Swedish Pulp and Paper Industry Engineers Association, and I understand he is one of only four people who have been accorded this honor. In addition, Gunnar is a member of the Canadian Pulp and Paper Association, the Swedish Academy of Engineering Science, the Engineering Institute of Canada, the Engineers Club of New York, etc.

In 1950 Mr. Nicholson was selected as one of a team of three to go to Austria as a representative of the American Government to help through the Marshall Plan in rehabilitating the Austrian paper industry. Unfortunately he was unable to accept this assignment.

Considering that you have most certainly earned this award, it is a great pleasure to me to present to you, Gunnar W. E. Nicholson, this TAPPI Medal, which is the highest honor which this organization can confer.

Response by Mr. Nicholson

It is with sincere thanks and a feeling of deep humility that I accept the outstanding honor you have conferred upon me by naming me the recipient of the TAPPI Gold Medal for 1953 in recognition of services rendered to the technical advancement of the pulp and paper industry.

In expressing to you my deep appreciation of this high award, I would like to take the opportunity to say how grateful I am for the stimulating influence, the fine fellowship, and the friendliness which are accorded me by my associates in this influential and progressive organization.

TAPPI, with its 6000 members, has played a great and important role over the years in contributing to the development, growth, and stability of the pulp and paper industry. As the industry's principal medium for the collection and dissemination of information through the printed and spoken word, it has been instrumental in eliminating, to a great degree, that secrecy of operation which for many years stood as a bulwark against the free exchange of ideas and information.

The natural development in our industry has been in the direction of greater integration; that is, by making our plants more self-sufficient and more profitable through the conversion of wood, our principal raw material, into a greater number of finished or end-use products. It may be timely and proper to stress briefly the need of extending such integration beyond our woodyards and plants and into the forests with the idea in mind of devising ways and means of not only producing greater numbers of higher quality trees but of harvesting them more economically.

When we consider that the cost of pulpwood delivered to the pulp mill represents two thirds of the total cost of making slush kraft pulp, as is the case today, we must recognize this as a challenge to technical men to increase the quality and productivity of our forests and to improve the methods of harvesting pulpwood. This becomes more obvious when we weigh the potential productivity of our woodlands and the fact that the cost of harvesting and delivering a cord of wood amounts to 75% of the total cost of pulpwood delivered to the pulp mill.

Our failure to utilize technical knowledge in the woods to the extent that we do in our plants is evidenced by the fact that of all trees harvested, only half of the total volume is converted into finished products. Likewise, a great number of species of wood growing plentifully in some sections of our country are, at the present time, in little demand or have practically no economic value.

I believe that the present product research and development activities should be extended and in many cases combined with those of forestry research. I believe that in the future woodlands operations, whether they pertain to the productivity of land, the harvesting and transportation of pulpwood, or the utilization of sawmill waste, must be organized and managed in much the same manner as we today operate our pulp and paper mills. This will call for the services of technical men in the mechanical, chemical, civil, industrial, and forestry engineering fields.

Future needs will require more wood, and farsighted management must anticipate this contingency. Proper planning for our needs for tomorrow demands more extensive research without expectation of immediate returns on our investments in such fields as biology, physics, chemistry, silviculture, ecology, physiology, entomology, and genetics.

Another territory which TAPPI and its membership might well afford to explore more fully is that of human relations. People represent our most valued resource, and the key to their greatest productivity is "work happiness." This is attained largely through the recognition by management of the dignity of the individual and the importance of the individual job. The development of contented and productive employees is not a Utopian dream. This can be accomplished, but the process is necessarily slow and does involve continuous study and training. We must develop techniques which will make every employee feel that he is really a part of the team and which tend to dignify his particular job and his place in the organization. In short, we must strive to inculcate in each employee a greater understanding and deeper appreciation of his individual importance in the scheme of things.

In any plan or program we might develop in the interest of our employees, we should provide for the training and further education of young men and women who, although lacking high school diplomas or college degrees, possess natural qualities and characteristics which can be recognized as out-

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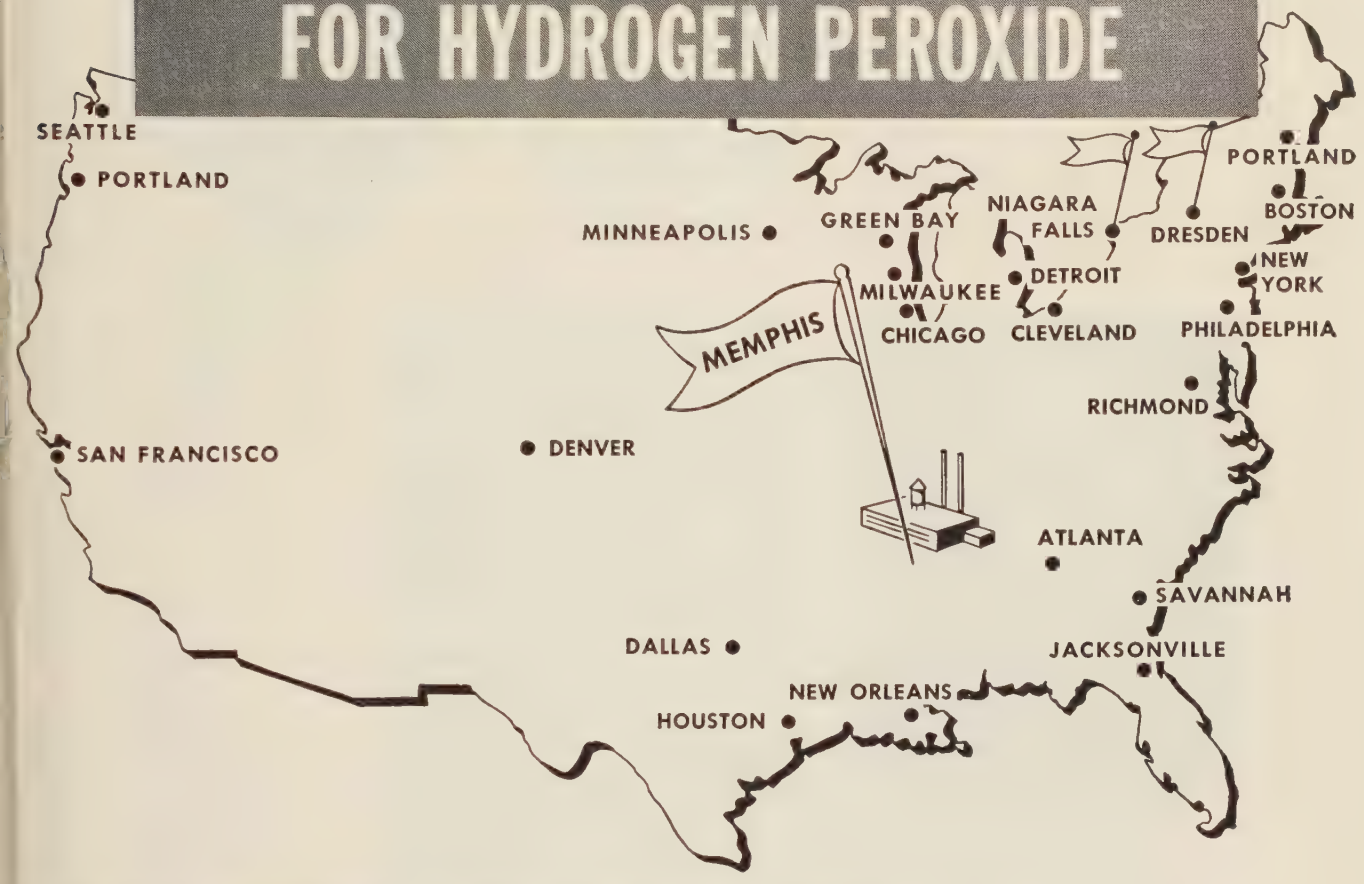

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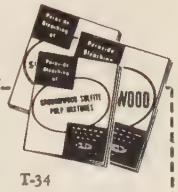

T-34

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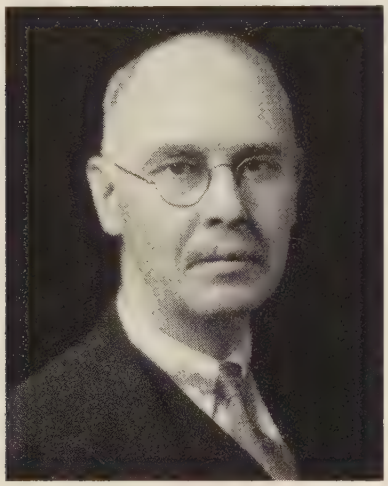
standing. In every person's make-up there is an innate desire to improve his lot in life, and this ambition should not be throttled because of the individual's lack of a formal education. A nugget in the rough, when placed in the hands of the skilled artisan, soon becomes a thing of beauty and great value.

I am indeed grateful to you for the recognition you have paid me today, and may I leave with you this sage counsel by a contemporary historian:

"Unless we find a way to restore the contact between the life of society and the life of the spirit, our civilization will be destroyed by forces which it has had the knowledge to create but not the wisdom to control."

Report of Standards Committee for 1953

The upsurge in Standards activity mentioned in last year's report (*1*) continued during 1953. The various committee and



Roger C. Griffin, Chairman of the TAPPI Standards Committee

sectional meetings undoubtedly are providing a valuable stimulus. Seventeen letter ballots were sent to the members of the Standards Committee, the same number as in 1952.

New and Revised Standards

During the year nine new Suggested Methods and three new Tentative Standards were approved for publication and all but one were published as indicated below:

T 231 sm-53. Zero-Span Breaking Length of Pulp (*2*)
T 232 sm-53. Fiber Length and Coarseness of Pulp by Projection (*3*)
T 233 sm-53. Fiber Length of Pulp by Classification (*4*)
T 483 sm-53. Odor of Packaging Materials (*5*)
T 484 m-53. Moisture in Paper by Toluene Distillation (*6*)
T 485 m-53. Pinholes in Glassine and Greaseproof Papers (*7*)
T 486 sm-53. Blood Resistance of Butchers' Wrapping Paper (*8*)
T 637 sm-53. Viscosity of Starch and Starch Products (*9*)
T 638 m-53. Analysis of Starch and Starch Products (*10*)
T 639 sm-53. Needle Penetration of Petroleum Waxes (*11*)
T 640 sm-53. Hardness of Rubber-Covered Rolls (Plastometer Test) (*12*)
T 641 sm-54. Total Water in Pulp Mill Spent Liquors

Revisions of the following two Tentative Standards were approved and published:

T 628 m-43. Analysis of Rosin Size (*13*)
T 401 m-42. Fiber Analysis of Paper and Paperboard (*14*)

A proposed revision of Official Standard 0 400 p-44, Standard Terms Used in the Sulphate Pulping Process, was approved and published (*15*). This is being submitted to letter ballot of the TAPPI membership. A revision of T 615 m-44 was also approved and published (*16*). The title of the latter was changed to Analysis of Calcium Sulphate Fillers and the revision confines the method to fillers of this class.

The following have been submitted to letter ballot of the TAPPI membership for advancement from Tentative to Official Standards:

T 462 m-43. Printing-Ink Permeation of Paper (Castor-Oil Test)
T 470 m-47. Edge Tearing Resistance of Paper
T 222 m-50. Acid-Insoluble Lignin in Wood Pulp

In addition three new methods and three revisions are at present before the Standards Committee for consideration. Some of these have been returned to the originating committee for further action.

Contents of Book of Standards

The manuscript for the annual printing of looseleaf Standards for 1953 was sent to the New York office during the Summer and early Fall and the final proof was read October 31. The printing was not mailed, however, until more than 2 months later. While this is an improvement over the previous year, the delay apparently due to the printer, still seems excessive. The mailing consisted of the following:

New numerical and alphabetical indexes
8 new Suggested Methods
1 Suggested Method advanced to Tentative Standard
4 new Tentative Standards
2 revised Tentative Standards
4 Tentative Standards advanced to Official
1 reapproved Official Standard
2 revised Official Standards
12 corrected Standards

The looseleaf manual now consists of the following:

	Tentative	*Official*	*Total*
Standard recommended practices	0	13	13
Standard specifications	4	1	5
Standard testing methods	46	116	162
Suggested methods	..	...	24
	50	130	204

Jurisdiction of Committees

The 12 new methods listed are under the jurisdiction of the following committees:

Chemical Methods	T 484 m
Engineering Research and Design	T 640 sm
Nonfibrous Materials Testing	T 637 sm, T 638 sm, T 641 sm
Packaging Materials Testing	T 483 sm
Paper Testing	T 485 m, T 486 sm
Pulp Testing	T 231 sm, T 232 sm, T 233 sm
Wax Testing	T 639 sm

Change in Committee Personnel

Ken Warner left in November for a year's stay in the Azores Islands. It was felt best, therefore, to replace him on the Standards Committee. James P. Casey, of A. E. Staley Mfg. Co., Decatur, Ill., has been appointed in his place. Mr. Casey has also become general chairman of the Testing Division to replace James d'A. Clark, who has resigned after many years' service. The ten committees in this division have furnished over 90% of the TAPPI Standards and Suggested Methods. During his tenure, Jim Clark's wide experience and knowledge and his faithful and energetic application to the job have been of great assistance in getting TAPPI Standards and Methods through the mill. The new Jim will have a good example on which to set his sights and we wish him all success.

Cutting the Time Lag

It takes a long time to develop a TAPPI Standard and it is of no use to anyone until it is actually born—that is, pub-

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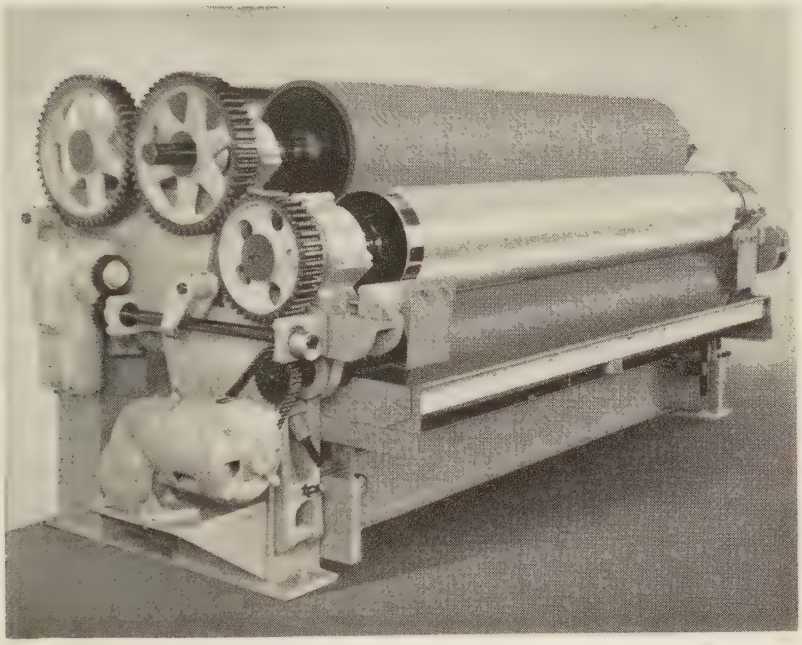

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lished. Anything that can be done, therefore, to minimize unnecessary delays is well worth while. Some of the ways in which this can be accomplished by committee chairmen are:

1. Answer letters promptly: If a complete reply cannot be given at once, acknowledge the letter and state approximately when a reply may be expected.
2. Set a deadline for letter ballots of committees and abide by it.
3. Have proposed Standards written according to TAPPI format. This can easily be done by consulting the regulations in the Year Book and checking the proposed Standard against those already published.
4. Send a copy of the first rough draft to the Standards Committee chairman for a preliminary check. (Ten copies of the *final* draft should be submitted.)
5. When the report of a committee meeting having to do with Standards is submitted to the New York office for publication, send an extra copy to the chairman of the Standards Committee. This also applies to the annual lists of committee projects which are sent to the New York office.

Literature Cited

1. *Tappi* 36, No. 3: 90A (March, 1953).
2. *Tappi* 36, No. 7: 141A (July, 1953).
3. *Tappi* 36, No. 9: 121A (Sept., 1953).
4. *Tappi* 36, No. 9: 125A (Sept., 1953).
5. *Tappi* 36, No. 3: 146A (March, 1953).
6. *Tappi* 36, No. 4: 137A (April, 1953).
7. *Tappi* 36, No. 9: 124A (Sept., 1953).
8. *Tappi* 36, No. 9: 124A (Sept., 1953).
9. *Tappi* 36, No. 4: 139A (April, 1953).
10. *Tappi* 36, No. 4: 135A (April, 1953).
11. *Tappi* 36, No. 8: 179A (Aug., 1953).
12. *Tappi* 36, No. 9: 120A (Sept., 1953).
13. *Tappi* 36, No. 3: 142A (March, 1953).
14. *Tappi* 36, No. 8: 170A (Aug., 1953).
15. *Tappi* 36, No. 11: 170A (Nov., 1953).
16. *Tappi* 36, No. 4: 134A (April, 1953).

Roger C. Griffin, *Chairman*

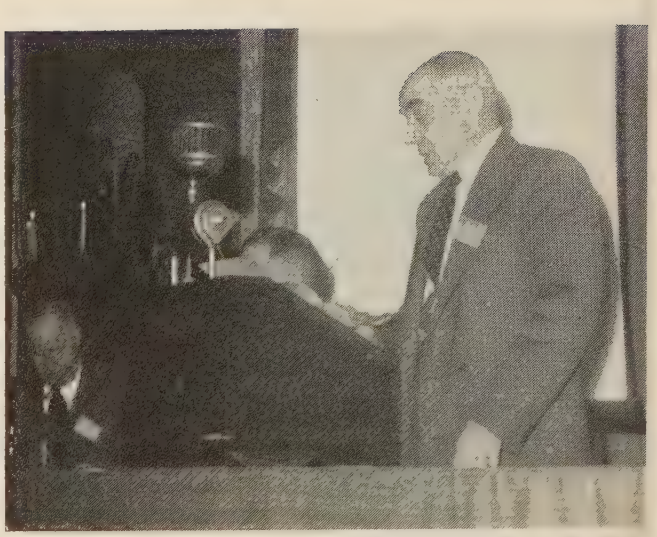
Report of the Joint Textbook Committee

The preparation of the latest and fourth edition of "Pulp and Paper Manufacture" has involved more work and very much more time than was anticipated when the project was first discussed by the committee at the meeting on Feb. 15, 1944. An extract from the minutes of that meeting is as follows:

"There was extended discussion regarding the desirability of starting at this time to prepare for revision of Volumes III, IV and V of the textbooks as soon as favorable circumstances for their publication occur after termination of the war. Recognition was also given to the fact that various scientific and technical developments for war purposes will find application in the pulp and paper industry in peace time. Such developments, together with the natural progress of the industry make necessary thorough revisions of the texts upon pulp and paper making in order that, as has been the case for so many years past, these volumes may continue to be the standard source of reference and instruction throughout the world."

At another meeting on May 29, 1945, it was thought that it might be possible for the editor to have all the manuscript for the proposed four volumes in hand not later than February, 1946, with the purpose of having the printing completed and the texts on sale early in 1947. It was hoped to bring out the four volumes simultaneously. How much too sanguine these hopes were is indicated by the fact that new Volume I went on sale in September, 1950, Volume II in October, 1951, and Volume III early in June, 1953.

The manuscript for Volume IV was delivered to the publishers in September, 1953, but there have been so many additional details to check up on that it is not yet quite ready to be sent to the printer. The best that can be hoped for now is the issuance of Volume IV not later than Sept. 16, 1954—exactly 36 years after the organization of this committee at a historic meeting in Buffalo, N. Y.



J. N. Stephenson presenting the report of the Joint Textbook Committee

For the sake of the record, it should be repeated that the committee began its activities with total funds of $57,000 in round numbers of which $27,000 was appropriated by the Canadian Pulp and Paper Association and $30,000 contributed by firms and individuals in the United States pulp and paper industry. Since the time of organization, expenditures have exceeded $105,000 and the committee is still solvent. This financial miracle, of course, results from the payment of royalties by McGraw-Hill upon all volumes sold in accordance with a contract which has been highly satisfactory both to the publisher and to the industry. During all these years the committee has scrupulously dedicated these funds to the production of these standard textbooks and the promotion of their use. A total sale of over 65,000 copies of the several volumes and editions is some indication of the effectiveness of this historic undertaking—and there are still a great many individuals and important organizations who have not yet profited by the opportunity thus afforded to learn the fundamentals of the many processes employed in pulp and paper manufacture and the types of equipment best adapted to these operations.

As the committee has often said before, it is deeply grateful to J. N. Stephenson who has been on its letterhead as editor since Jan. 1, 1919. Likewise, it recalls with pleasure its long-time association with McGraw-Hill Book Co. whose high standards of production and world-wide system of distribution have contributed so greatly to the success of this experiment in international industry-wide cooperation. Still further and perhaps most important of all, the committee is deeply indebted to the large number of individuals in the industry who, despite their own continuously responsible and exceedingly great activities in their chosen fields, have written the individual sections of the textbooks, and to still others equally qualified whose suggestions and criticism have contributed to the accuracy and authenticity of all the volumes.

Financial Details

The financial activities of the committee during the year are summarized as follows:

Receipts:		
Cash on hand Jan. 1, 1953	$1310.48	
Royalties received during year	2991.22	
		$4301.70
Expenses:		
Salaries	$1200.00	
Revision expenses	886.26	
Complimentary books	868.00	
Miscellaneous expenses	319.88	
		3274.14
Assets:		
Cash on hand Jan. 1, 1954		$1027.56

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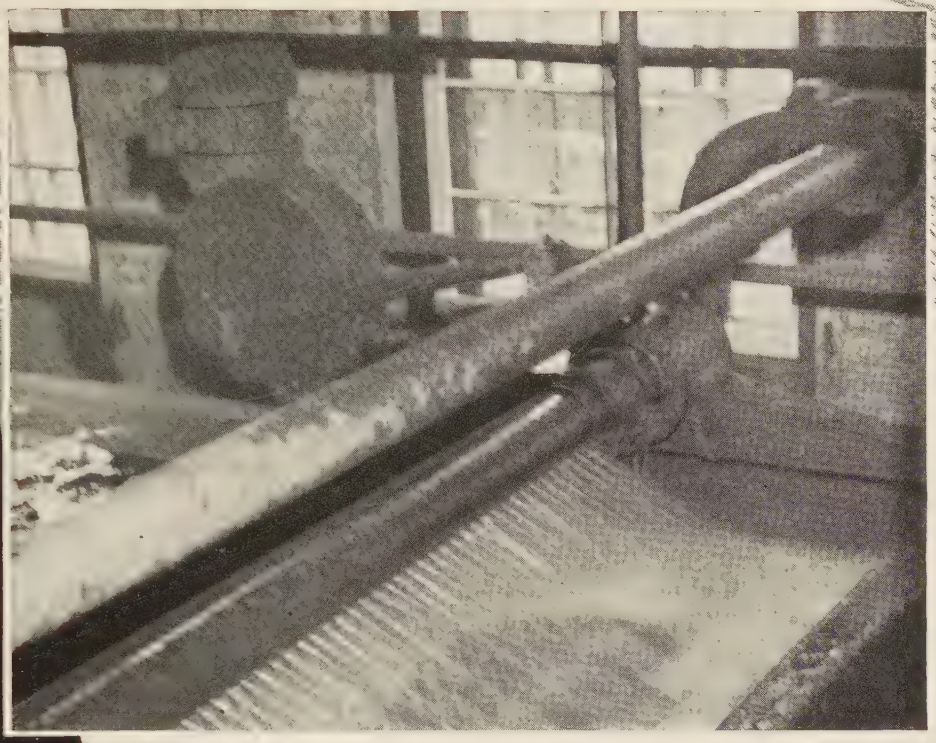

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Screening is free and complete. The plates are washed clean, leaving no matted fibre to dry and plug the slots during shut-downs and interruptions. They are ready to screen immediately.

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Textbook Sales

The publishers report current and total sales of the four editions and several volumes of the textbooks with the following figures:

	1953 Sales	*Grand Total (revised)*
First three editions:		
Volume I	7	6,352
Volume II	Out of print	5,511
Volume III	Out of print	15,339
Volume IV	1	12,675
Volume V	87	11,529
Total	95	51,406
Fourth edition:		
Volume I	1115	6,795
Volume II	1209	4,413
Volume III	3055	3,055
Total	5199	14,263

Grand Total since 1921—65,669

R. S. KELLOG, *Secretary*

TAPPI 1954 Executive Committee

As reported by the Tellers Committee, George H. Pringle and Karl O. Elderkin were re-elected President and Vice-President, respectively, of the Technical Association.

Members of the Executive Committee whose terms continue are L. K. Burnett, Ohio Boxboard Co., Rittman, Ohio; G. A. Day, Brown Co., Berlin, N. H.; H. F. Lewis, Institute of Paper Chemistry, Appleton, Wis.; J. R. Lientz, Union Bag & Paper Corp., Savannah, Ga.; N. I. Bearse, Champion-International Co., Lawrence, Mass.; John Buss, Provincial Paper, Ltd., Toronto, Ont.; H. C. Moore, Beloit Iron Works, Beloit, Wis., and C. J. Sibler, West Virginia Pulp & Paper Co., New York, N. Y.

The members of the Executive Committee whose terms expired in February, 1954, were R. P. Price, Hammermill Paper Co., Erie, Pa.; W. F. Holzer, Crown Zellerbach Corp., San Francisco, Calif.; W. F. Hathaway, Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich., and W. D. Harrison, Riegel Paper Corp., Milford, N. J.

Following are brief biographies of the individuals elected to serve the Association as members of the Executive Committee for the next 3 years.

Ward D. Harrison was re-elected to membership on the Executive Committee.

Roy L. Davis, vice-president of the Detroit Sulphite Pulp and Paper Co., Detroit, Mich., was born in Athens, Me., in 1907 and graduated from Bates College in 1927. In 1933 he received his Ph.D. degree from The Institute of Paper Chemistry, one of the first two graduates of that institution. From 1927 to 1930 he was employed as a research chemist by S. D. Warren Co., Cumberland Mills, Me. In 1933 he took charge of the laboratories of the Interlake Division of the Consolidated Water Power & Paper Co. Later he joined the organization of the Detroit Sulphite Paper Co. as technical director. He was in turn advanced to the positions of general superintendent and vice-president in charge of production.

Fleming D. Long, technical director of the Container Corp. of America, Chicago, Ill., was born in Monmouth, Ill., in 1915 and graduated from Monmouth College as a chemist in 1938. From 1938 to 1940 he was a teaching fellow at Louisiana State University and in 1940 joined the staff of the Corn Products Refining Co. at Argo, Ill., as a chemist. Since 1941 he has been employed by the Container Corp. of America. In TAPPI he has been chairman of the Chicago Section and chairman of the Corrugated Containers Committee.

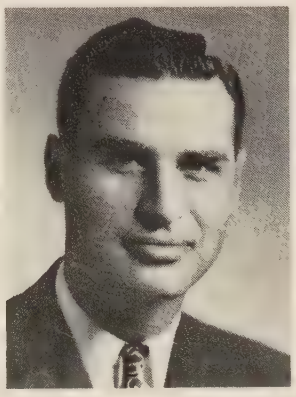
Robert I. Thieme was born in Seattle, Wash., in 1912 and graduated as a chemical engineer from the University of Washington in 1934, following which he joined the technical staff of the Soundview Pulp Co., Everett, Wash. Except for an interim of 4½ years of service in the U. S. Navy he has been with this company which is now part of the Scott Paper Co. In 1953 he became plant manager of the Anacortes Division of the Scott Paper Co.

Research Appropriations Committee

During 1953 sixteen requests for research grants were received from seven Association committees. Of these requests, ten were approved unanimously by the Research Appropriations Committee and three were referred to the Executive Committee for decision. The latter committee has approved one of the three requests. The funds appropriated for 1953 committee projects total an all-time high, namely, $35,950 and yet these were distributed to only five committees. Too few committees avail themselves of the opportunity of financial support for their projects. The purpose of this aid is to permit committees to carry out projects, some of which they would be unable to handle otherwise, and thereby accelerate their program of activities, thus contributing in greater measure to the objects of TAPPI. Over forty major committees are listed in the Year Book and most of these have never requested financial aid for their work.

Over $105,000 has been appropriated by the Association since 1935 when the Executive Committee initially voted to authorize the expenditure of funds for committee aid. A summary of all committee projects supported in part or as a whole by TAPPI research grants from 1935 through 1952 was prepared and published in the October, 1953, issue of *Tappi*,

Ward D. Harrison, Riegel Paper Corp., Executive Committee



F. D. Long, Container Corp of America, Executive Committee

Robert I. Thieme, Scott Paper Co., Executive Committee

John L. Parsons, Chairman, Research Appropriations Committee

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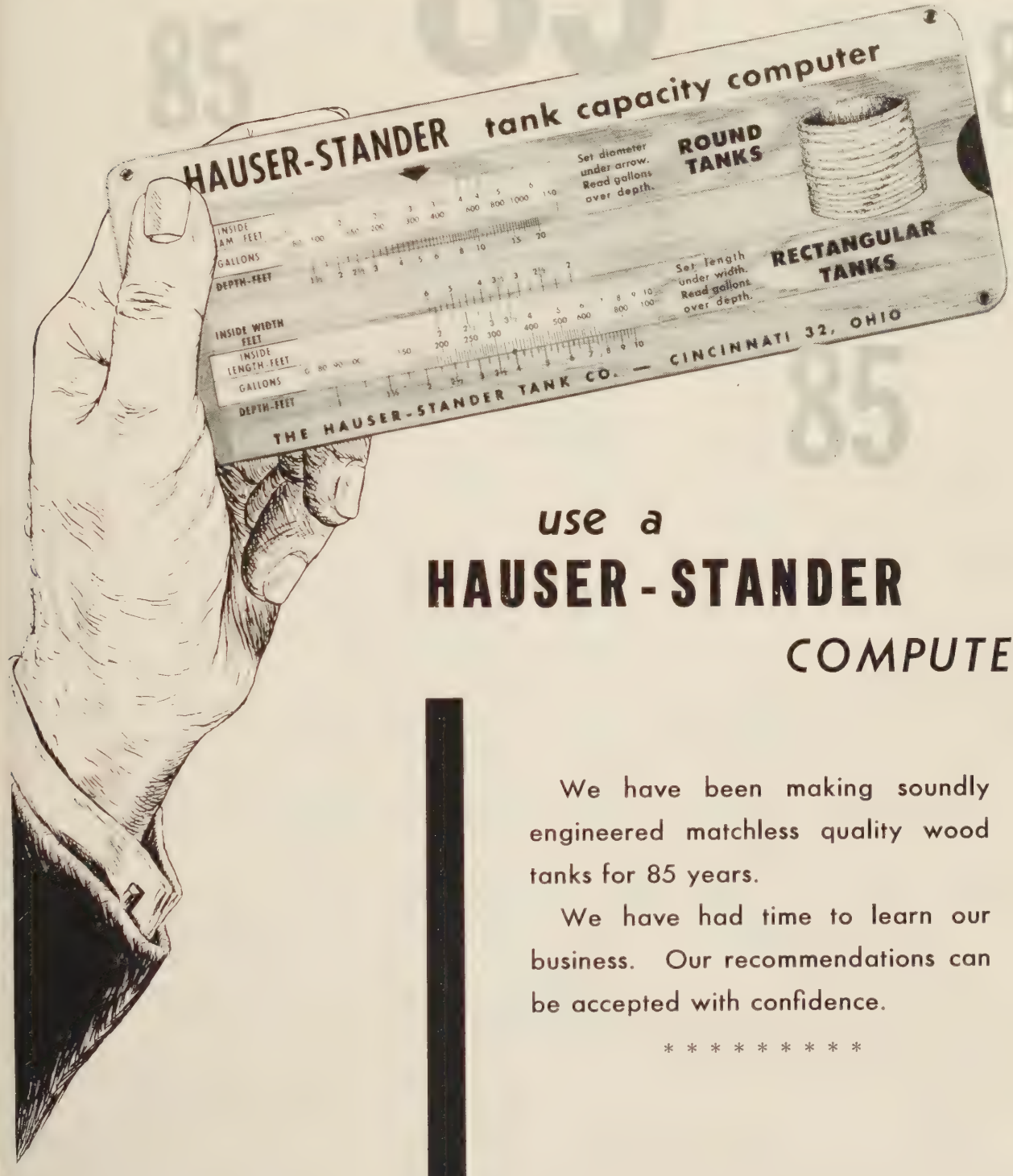

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pages 80A and 82A. Literature references of all published reports on these listed projects were included in the summary.

The requests received and grants made during 1953 are summarized in the following table:

Request No.	Project	Committee	Amount
50	Study of Corrosion in Alkaline Digesters by Analysis of Wall Thickness Measurements	Chemical engineering (Digester corrosion Subcommittee)	$6,000
51	Permeability of Plastics Treated Paper to Gases and Liquids	Plastics	$5000–$7000
52*	Study of Skinlike Substance from Residues of Pulp Fiber Treatment (continuation of no. 30)	Fundamental Research	($2,500)
53	Dye Absorption Method of Determining the External Specific Surface of Pulp and Correlation with Other Fiber Properties (continuation of no. 31)	Fundamental Research	$2,800
54	Structure of Lignin (continuation of no. 24)	Fundamental Research	$1,500
55	Sulfonation of Lignin	Fundamental Research	$3,000
56	A Study of Certain Factors Involved in Semichemical Pulping	Fundamental Research	$5,000
57	Method for the Determination of the Chain Length of Cellulose (continuation of no. 48)	Chemical Methods	$900
58	Development of a Method for the Measurement of the Ratio of Crystalline to Amorphous Material in Cellulose	Chemical Methods	$900
59*	Dirt in Wood Chips (revision of Tentative Standard T 14 m-47)	Fibrous Materials Testing	$2,050
60	A Study of the Reaction Between Water and Cellulose in the Temperature Range 100°C. and 225°C.	Fundamental Research	$2,000
61*	Losses of Straw Stored in Ricks	Fibrous Agricultural Residues	($5,500)
62	Study of North American Barks (renewal of no. 44)	Fundamental Research	($4,800)
63	F.P.L. Small-Scale Tunnel Fire Test	Structural Fibrous Materials	$2,000
64	Friction of Paper Stock in Pipes (renewal of no. 49)	Hydraulics	($11,000)
65	Nature of Uronic Acids	Fundamental Research	($1,500)
		Total	$35,950

Items in parentheses not included.

Requests identified by one asterisk (*), nos. 52, 59, and 61, were not unanimously approved but received a majority endorsement by the committee, and were referred to the Executive Committee for final decision. No. 59 has been granted by the latter committee.

No. 64 is presently being considered by the Research Appropriations Committee. No. 63 is being held in abeyance at the request of the Structural Fibrous Materials Committee. No. 65, received in 1953, did not receive the endorsement of the committee until January, 1954.

Progress reports on committee projects now being supported by TAPPI funds are appended to this report.

With the adopted policy of rotating committee personnel and a 3-year tenure, the following members retire at this time: Allen Abrams, A. E. Bachmann, and H. W. Bialkowsky. Their successors are James d'A. Clark, Clark C. Heritage, and Wendell W. Moyer. The Research Appropriations Committee for 1954 comprises the following personnel:

G. H. Pringle (*ex-officio*)
K. O. Elderkin (*ex-officio*)
W. F. Gillespie (1954)
J. W. Hemphill (1954)
J. D. Malcolmson (1954)
A. L. Sherwood (1955)
W. H. Swanson (1955)
K. P. Geohegan (1955)
J. d'A. Clark (1956)
C. C. Heritage (1956)
W. W. Moyer (1956)
J. L. Parsons, *Chairman*

Progress Reports of Current Committee Projects Financed by TAPPI Research Grants

Research Grant No. 21—Variation of Drying Rates of Individual Driers through the Drier Section. Drying and Ventilating Committee.

This investigation has been completed, and the results were published in an article of the above title by A. E. Montgomery, in the January, 1954, issue of *Tappi*, vol. 37, pages 1–13. This report was presented at the Montreal Engineering Conference.

Research Grant No. 32—Determination of the Effect of Rate of Loading in the "Flexural Resistance and Deflection of Fiberboard" Test. Structural Fibrous Materials Committee.

The work and reports have been completed, and a Suggested Method prepared for committee approval. The final report will be presented at the 1954 Annual Meeting.

Research Grant No. 33—Determination of a Method of Test for the Racking Strength of Insulating Board Sheathing. Structural Fibrous Materials Committee.

Progress has been made on this project but no definite results are available at the present.

Research Grant No. 35—Construction and Testing of a Test Board Forming Machine for Structural Fibrous Materials. Structural Fibrous Materials Committee.

Complete equipment is now on hand and testing work has begun at the Celotex Laboratory. After these tests are completed, other interested mills and laboratories will use the equipment.

Research Grant No. 36—Analysis of Data on Corrosion of Digesters in Kraft and Soda Mills. Chemical Engineering Committee.

This work has been completed and was published under the title "Corrosion of Alkaline Pulping Digesters," by R. S. Peoples and G. L. Ericson in *Tappi*, vol. 35, pages 403–409 (Sept., 1952).

Research Grant No. 40—Development of a Standard Method for Analysis of Mill Waste—Suspended Solids Determination by Buchner vs. Gooch Methods. Water Committee.

The status of this project is the same as reported last year. Further plans are under consideration by the committee.

Research Grant No. 41—Construction of Two Drainage Time Testers of New Design. Structural Fibrous Materials Committee.

The two drainage time testers have been redesigned and are now in working order. At the Annual Meeting will be presented the following papers: (1) comparison of results using the testers by the Forest Products Laboratory and the Flintkote Laboratory, (2) analysis of mill results using control methods devised for the tester, and (3) comparison of results between this tester and other testers. Plans are being made for circulating the time testers for trial purposes to interested board mills and laboratories.

Research Grant No. 42—Purchase, Alteration and Evaluation of a Baumgartner Sphere for Measurement of the Light Reflection from Insulating Board Finishes and Coatings. Structural Fibrous Materials Committee.

Complete equipment is on hand and testing work has be-

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Guayaquil, Ecuador
Manchester, England
Paris, France
Athens, Greece
Enschede, Holland
Bombay, India
Teheran, Iran
Tel-Aviv, Israel
Milano, Italy

Karachi, Pakistan
Lima, Peru
Manila, Philippines
Porto, Portugal
San Juan, Puerto Rico
Bangkok, Siam
Johannesburg, S. A.
Barcelona, Spain
Norrkoping, Sweden

gun at the Celotex Laboratory. After the tests are completed, the equipment will be sent to other interested mills and laboratories for testing.

Research Grant No. 43—Species Identification of Wood and Wood Fibers. Fibrous Materials Testing Committee.

The development of a new key using marginally perforated cards and enlarging the number of species for a revision of T 8 sm-40 is now at a stage where 100 species of softwoods and 65 species of hardwoods are on cards. It is anticipated that about 2000 samples will be checked to insure the highest possible accuracy with the key. It is hoped the project will be completed in 1954.

Research Grant No. 44—See Research Grant No. 62.

Research Grant No. 45—Cellulose Viscosity Methods. Chemical Methods Committee.

Work has been continued on the viscosity project which has involved a study of two solvent systems—cuprammonium and cupriethylenediamine. Based on a report prepared in July, 1953, a tentative procedure has been prepared which may be a forerunner of a TAPPI Standard Method on viscosity, which it is hoped will be approved by both ACS and ASTM.

Research Grant No. 46—Correlation between Lignin Content and High Kraft Yield Pulps and the Chlorine Number Test. Alkaline Pulping Committee.

Correlation of lignin and chlorine number (9.5 17.5 range) of various high yield kraft pulp samples confirms a linear relationship between these two tests. A discrepancy in the calculated and experimental values is being investigated by a plan of cross checking laboratory techniques.

Research Grant No. 49—Friction Loss of Paper Stock in Pipes. Hydraulics Committee.

An interim report was presented at the Montreal Engineering Conference that showed a correlation has been established between the laboratory shear tester and pipe friction loss. All work done to the present time has been on West Coast bleached sulphite pulp, but other pulps will be studied, namely, southern unbleached kraft and northern hardwood sulphite. To remedy the defects in the shear tester it will be redesigned and a new one will be constructed.

Research Grant No. 50—Corrosion in Alkaline Digesters by Analysis of Wall Thickness Measurements. Chemical Engineering Committee.

This project has been completed by the Armour Research Foundation. A summary report by Nicholas Shoumatoff and H. O. Teeple was presented at the Montreal Engineering Conference. Plans are being made for the publication of the complete Armour Report.

Research Grant No. 51—Permeability of Plastic Treated Paper. Plastics Committee.

The proposed plan of research and the potential value of the program have been thoroughly discussed by the subcommittee which is directing this project. Work on the project was commenced Dec. 1, 1953.

Research Grant No. 53—Dye Adsorption Technique for Determining the External Specific Surface of Fibers. Fundamental Research Committee.

A report of earlier work on this project appeared in *Tappi* 36: 498–504 (Nov., 1953). During 1953 effort has been concentrated on (1) effect of drying, (2) reproducibility of results, and (3) correlation of dye adsorption with properties of various pulps. A final report will be prepared and probably presented at the 1955 Annual Meeting.

Research Grant No. 54—Structure of Lignin. Fundamental Research Committee.

Work is already under way at Bucknell University on this project but there has been a delay owing to the lack of a graduate student. Effort is being directed to obtain a student assistant.

Research Grant No. 55—Sulphonation of Lignin. Fundamental Research Committee.

Initial work has been started on this project but difficulty has been experienced in having adequate man power for the subject.

Research Grant No. 56—Factors in Semichemical Pulping. Fundamental Research Committee.

Work is being pursued actively on this subject. The building and procurement of apparatus have been slow but one man is devoting three quarters of his time to the work and he has a full-time analytical assistant. One or more papers are anticipated from the project during 1954. The investigation includes studies of the forces involved in separating the fibers of semicooked wood, of the paths through wood available for the diffusion of ions, and of the alkaline pulping of aspen in liquors over the pH range 11–13.3.

Research Grant No. 57—Determination of the Molecular Weight Distribution of Cellulose. Chemical Methods Committee.

Based on fractionation tests to improve technique and the analysis of five widely different pulps, a suggested method is being prepared and will be submitted to the committee during the 1954 Annual Meeting.

Research Grant No. 58—Development of a Method for the Measurement of the Ratio of Crystalline to Amorphous Material in Cellulose. Chemical Methods Committee.

A thorough literature survey has been made on the methods so far proposed for the determination of accessibility. On the basis of accuracy, reproducibility, and simplicity, water vapor sorption, density determination, and chromium trioxide oxidation were chosen as the promising methods for further investigation. This literature review will be presented at the 1954 Annual Meeting.

Research Grant No. 59—Dirt in Wood Chips, Revision of Tentative Standard T 14 m-47. Fibrous Materials Testing Committee.

Work on this project will get under way in 1954.

Research Grant No. 60—A Study of the Reaction between Water and Cellulose in the Temperature Range 100°C. and 225°C. Fundamental Research Committee.

Purified cotton linters and a highly purified commercial wood pulp have been subjected to a temperature range 130° and 180°C., in the presence of boiled distilled water in a steel autoclave. Decomposition of the cellulose began about 160° C. and increased with elevation of the temperature. The pH of the water dropped from 6.5 to 5.5 at 180°C. and also the viscosity was reduced. The alpha-cellulose content decreased as the cooking temperature was increased; the beta-cellulose increased while the amount of gamma-cellulose increased very slowly. The major difference between the wood pulp and the cotton linters was the greater conversion of alpha into beta-cellulose with the former at a given temperature. The effect at higher temperatures is now being studied, as well as the action of buffers.

Research Grant No. 62—Study of North American Barks. Fundamental Research Committee.

Research grant no. 44 has been extended to grant no. 62 for the above project. The work accomplished during 1952–53 has been brought together in the form of a volume of several hundred pages. Arrangements are being made to publish this report in the form of a monograph. The projected study will be different in nature from the one now being reported.

JOHN L. PARSONS, *Chairman*

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PERSONAL MENTION

Items Abont New and Old Tappimen

New TAPPI Members

Rob Roy Adams, Partner and Head of Chemical Dept., J. E. Sirrine Co., Greenville, S. C., a 1922 graduate of Furman University.

Herbert B. Addington, Consulting Engineer, New York, N. Y., a 1917 graduate of Purdue University.

Frank W. Amadon, Jr., Sales Engineer, Warren Steam Pump Co., Warren, Mass., a 1933 graduate of Massachusetts Institute of Technology.

Anders P. Arlov, Research Associate, Pulp & Paper Institute of Canada, Montreal, P. Q. Canada, a 1949 graduate of Norwegian Institute of Technology.

James E. Ayer, Acting Head, Dept. of Pulp and Paper Technology, University of Alabama, University, Ala., a 1952 graduate of the University of Maine.

Abdul-Medjid Ayroud, Research Service, Ecole Francaise de Papeterie, Grenoble, Isere, France, a 1950 graduate of Ecole Francaise de Papeterie, with a Ph.D. degree.

P. Stanley Backlund, Research Chemist, Union Oil Co. of California, Research Centers, Brea, Calif., a 1940 graduate of the University of California.

Edward A. Barton, Field Engineer, Nash Engineering Co., South Norwalk, Conn., a 1930 graduate of Queens University, Kingston, Ont., Canada.

Edward W. Beardsley, Technical Salesman, Corn Products Sales Co., Portland, Ore., a 1935 graduate of Bradley University.

Daniel V. Benade, Managing Director, O. Bakke & Co. (Pty.) Ltd., Huguenot, C. P., S. A., a 1941 graduate of Stellenbosch University, a 1944 graduate of the University of South Africa, a 1947 graduate of Massachusetts Institute of Technology.

Richard J. Bouchard, Superintendent, Whale Safety Paper Co., Waupaca, Wis.

Sidney G. Briscoe, Sales Engineer, The Pusey & Jones Corp., Wilmington, Del. Attended the University of Maine.

Booker P. Bunch, Jr., Process Control Supervisor, The Mead Corp., Chillicothe, Ohio, a 1945 graduate of Lynchburg College.

Thomas F. Butler, Research Chemist, Champion Paper & Fibre Co., Hamilton, Ohio, a 1949 graduate of the University of Miami.

Elmer A. Christoferson, Laboratory Supervisor, Scott Paper Co., Everett, Wash. Attended the University of Washington.

Arlie W. Claxton, Project Leader, Edgar Bros. Co., McIntyre, Ga., a 1949 graduate of the University of Georgia.

John L. Colp, Plant Engineer, Chas. Dowd Box Co., Inc., Worcester, Mass., a 1943 graduate of the University of Illinois.

Richard H. Cordingly, Student, The Institute of Paper Chemistry, Appleton, Wis., a 1953 graduate of the University of Colorado.

Edward T. Costello, Control Chemist, Bird & Sons, Inc., East Walpole, Mass., a 1953 graduate of Lincoln Technical Institute of Northeastern University.

Victor R. Coudert, Jr., Pulp Salesman, Montmorency Paper Co., Inc., New York, N. Y., a 1946 graduate of Yale University and a 1950 graduate of Harvard University.

Kenneth A. Craig, Superintendent, Pulp, Paper and Newsprint Laboratory, Kimberly-Clark Corp., Neenah, Wis., a 1930 graduate of Iowa Wesleyan University, with a Ph.D. degree from Pennsylvania State College in 1934.

William S. Darr, Technical Service Engineer, Hercules Powder Co., Paper Makers Chemicals Dept., Milwaukee, Wis., a 1951 graduate of Boston College.

Dwight M. Davis, Factory Manager, Hercules Box Co., Columbus, Ohio, a 1941 graduate of Ohio State University.

J. Bayard Des Camp, Shift Superintendent, Rayonier, Inc., Shelton, Wash., a 1940 graduate of the University of Washington.

Joseph J. Dietzel, Technical Sales Representative, Buckman Laboratories, Inc., Memphis, Tenn., a 1934 graduate of Pratt Institute.

Dan S. Edgerton, Graduate Student, University of Maine, Orono, Me., a 1950 graduate of Bowdoin College.

Frank M. Ernest, Technical Service Dept., Solvay Process Div., Allied Chemical & Dye Corp., Syracuse, N. Y., a 1948 graduate of Ohio State University.

Edwin R. Fait, Sales Representative, Hercules Powder Co., Paper Makers Chemical Dept., Wilmington, Del., a 1929 graduate of the University of Pennsylvania.

Gordon N. Fisher, Service Representative, Minnesota & Ontario Paper Co., Minneapolis, Minn. Attended Hamline University.

John H. Fisher, Director of Research, MacMillen & Bloedel Ltd., Nanaimo, B. C., Canada, a 1935 graduate of the University of British Columbia, with a Ph.D. degree from McGill University in 1941.

Warren S. Flenniken, Chief Power Engineer, Rayonier, Inc., New York, N. Y.

William G. Foster, Process Control Supervisor, Masonite Corp., Ukiah, Calif., a 1948 graduate of Massachusetts State College.

Eli H. Fradkin, Plant Manager, Seaboard Container Corp., Bristol, Pa. Attended Russia Engineering College.

Charles G. Frei, Manager of Sales-Service Engineer, General Electric Co., New York, N. Y., a 1922 graduate of Polytechnic Institute of Brooklyn.

Satoru Fujimoto, Chief Engineer, Technical Div., The Kokusaku Pulp Industry Co. Ltd., Asahigawa Mill, Hokkaido Japan, a 1920 graduate of Toyotu School.

Hugh T. Gardner, Technical Service Representative, Buckman Laboratories, Inc., Memphis, Tenn., a 1947 graduate of the University of Montana, and a 1949 graduate of the University of Washington.

Alfred Graef, Technical Director, Pulp Div., Weyerhaeuser Timber Co., Everett, Wash., a 1937 graduate of the University of Wisconsin.

Robert J. Greenwalt, Control Chemist, Kimberly-Clark Corp., Kimberly, Wis., a 1941 graduate of Iowa State College.

Akira Hanada, Chief of Viscose Section, Rayon Mfr. Dept., Toho Rayon Co. Ltd., Tokushima Plant, Shikoku, Japan, a 1941 graduate of Tokyo Imperial University.

Walton M. Hancock, Quality Control Engineer, The Lord Baltimore Press, Baltimore, Md., a 1951 graduate of Johns Hopkins University.

Arne Hallencreutz, Resident Engineer, AB Svenska Flaktfabriken, Stockholm, Sweden. Attended Chalmers' College of Technology, Gothenburg, Sweden.

John C. Hanchett Plant Engineer, The Gardner Board & Carton Co., Middletown, Ohio. Attended the University of Wisconsin.

William D. Haskell, Sales Engineer, The Black-Clawson

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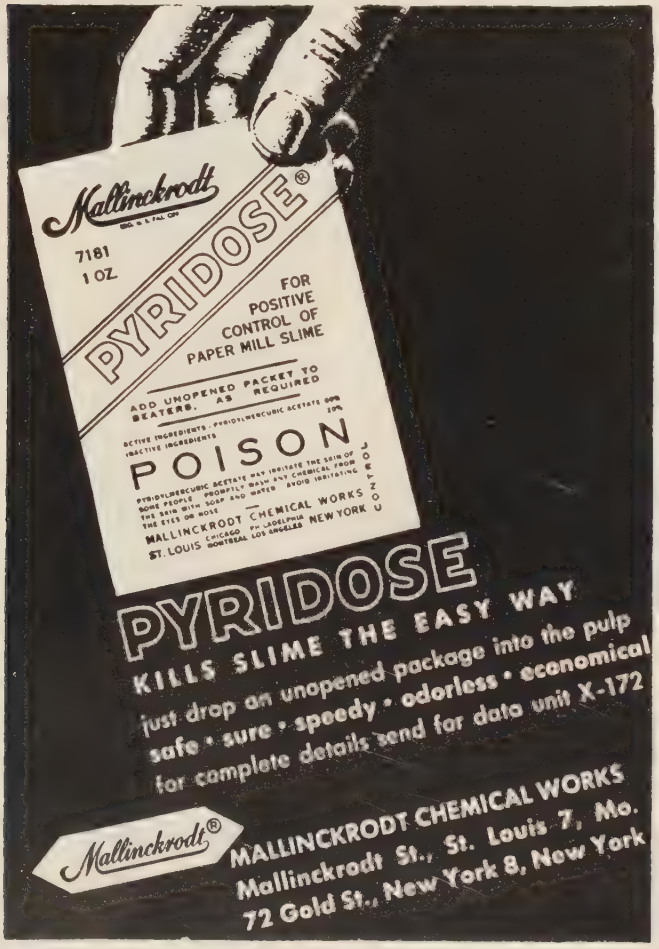
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Co., Dilts Machine Works Div., Fulton, N. Y. Attende the University of Maine.

Chester E. Hatch, Jr., Chemical Engineer, J. E. Sirrine Co Greenville, S. C., a 1937 graduate of The Citadel.

Ian F. Hendry, Personal Assistant to Research Manage Wiggins Teape & Co. Ltd., Glory Mill, High Wycomb Bucks, England, a 1950 graduate of Cambridge University.

Thomas G. A. Henstridge, Sales Manager, Montreal Casei Co., Regd., Montreal, P. Q., Canada.

John S. Hickman, Chemist, E. I. du Pont de Nemours Co., Wilmington, Del., a 1951 graduate of Emory University

Jack W. Holland, General Manager, Stocker Mfr. Co Netcong, N. J., a 1944 graduate of Syracuse University.

John D. Homan, President and General Manager, John D Homan Co., Tampa, Fla., a 1919 graduate of Williamson Co lege.

Rui-Tsung Hsieh, Research Assistant, Dept. of Pulp Paper, Taiwan Forestry Research Institute, Taipei, Formos China.

Geoffrey D. Hughson, Chief Chemist, Canadian Inter national Paper Co., Gatineau, P. Q., Canada, a 1949 graduat of McGill University.

Sven-Olof Hultin, Consulting Engineer, Ekono, Associatio for Power & Fuel Economy, Helsingfors, Finland, a 195 graduate of Abo Akademi.

John E. Humphreys, Process Control Engineer, Marinett Paper Co., Marinette, Wis., a 1946 graduate of Drexel In stitute.

M. V. Hunter, Research Chemist, California Researc Corp., Richmond, Calif., a 1948 graduate of the Universit of Washington.

Thomas E. Irwin, Senior Chemist, Meredith Publishing Co Des Moines, Ia., a 1948 graduate of Drake University.

Richard T. Jackson, Research & Development Chemist Riegel Paper Corp., Milford, N. J., a 1952 graduate of Lafa yette College.

Herbert E. Karp, Student, Lowell Technological Institut Lowell, Mass.

John W. Klein, Assistant Superintendent, Pulp Mi Longview Fibre Co., Longview, Wash., a 1937 graduate of t University of Washington.

George Kleinman, Sales Engineer, Swenson Evaporator Co Div. of Whiting Corp., Harvey, Ill., a 1949 graduate of I linois Institute of Technology.

Richard W. Kingerley, Assistant Manager, Industrial Proc uct Development, E. I. du Pont de Nemours & Co., Inc Wilmington, Del., a 1941 graduate of Columbia Universit with a Ph.D. degree.

Richard E. Kline, Mechanical Engineer, Riegel Paper Corp Milford, N. J., a 1949 graduate of the Cooper Union.

Louis J. Kotnik, Shift Chemist, Weyerhaeuser Timber Co Everett, Wash., a 1945 graduate of Case Institute of Tech nology.

Felix M. Kraus, Project Engineer, Stadler, Hurter & Co Montreal, P. Q., Canada, a 1936 graduate of the Universit of Zagreb, with a Dr. Eng. degree from the University Turin in 1947.

George J. Lane, Divisional Manager, Quebec North Sho Paper Co., Baie Comeau, P. Q., Canada, a 1913 graduate the University of Illinois.

Lye D. Larson, Plant Engineer, Inland Empire Paper Co Millwood, Wash., a 1948 graduate of Washington State Co lege.

John A. Lawrence, Salesman, Monsanto Canada Ltd Ville La Salle, P. Q., Canada, a 1951 graduate of the Unive sity of Toronto.

George W. Lewis, Jr., Head Shift Chemist, Hollingsworth Whitney Co., Mobile, Ala., a 1950 graduate of Spring Hi College.

Harry W. Macdonald, Comptroller, Canadian Forest Pro ucts Ltd., Howe Sound Pulp Div., Port Mellon, B. C., Canad

a 1949 graduate of the University of British Columbia, and a 1951 graduate of Oxford College.

Lennart Markila, Engineer, Enso-Gutzeit O.Y., Kotka, Finland, a 1939 graduate of the Technical Institute.

Don E. Marth, Student, Institute of Paper Chemistry, Appleton, Wis., a 1953 graduate of Lawrence College.

Logan W. Mather, Chemist, Gardner Board & Carton Co., Middletown, Ohio. Attended the University of Cincinnati.

John A. Meyer, Graduate Student, Forest Chemistry Dept., College of Forestry, Syracuse, N. Y., a 1950 graduate of Pennsylvania State College.

Michio Mii, Engineer, Akita Mokuzai Co., Ltd., Tokyo, Japan, a 1943 graduate of Tokyo University.

George E. Moore, Jr., Administrative Engineer, W. C. Nickum & Sons Seattle, Wash. Attended the University of Washington and Southwestern University.

Robert F. Morgan, Sales Representative, Allis-Chalmers Mfg. Co., Milwaukee, Wis., a 1948 graduate of Michigan State College.

Jack R. Murphy, Pulp Mill Shift Foreman, Champion Paper & Fibre Co., Pasadena, Tex., a 1930 graduate of the University of North Carolina.

Robert K. Newcomb, Methods Engineer, John Waldron Corp., New Brunswick, N. J., a 1949 graduate of Rutgers University.

D. Noel Obenshain, Research Engineer, West Virginia Pulp & Paper Co., Luke, Md.

Frederick C. Oppen, Research Chemist, Marathon Corp., Rothschild, Wis., a 1936 graduate of the University of Wisconsin.

Morris M. Peterson, Chemist, Columbia River Paper Mill, Vancouver, Wash., a 1934 graduate of the University of Washington.

Jaakko Poyry, Mechanical Engineer, Wartsila-Koncernen A.B., Helsinki, Finland, a 1947 graduate of Polytecknicum of Helsinki.

Dwight M. Reid, Technical Supervisor, Marathon Paper Mills of Canada, Marathon, Ont., Canada, a 1941 graduate of the University of Western Ontario.

Clarence H. Rice, Area Manager, Westinghouse Electric Corp., Philadelphia, Pa., a 1933 graduate of the University of Delaware.

Per Rinman, Managing Director, AB Celleco, Uppsala, Sweden, a graduate of Kungl. Tekn. Hogskolan, Stockholm.

John A. Rogers, Assistant Chief Engineer and Power Supervisor, Oxford Paper Co., Rumford, Me., a 1925 graduate of Nova Scotia Technical College.

Ludwig Rothamel, Engineer, Institut für Cellulosechemie, Technical University, Darmstadt, Germany, a graduate of the Technical University, Darmstadt with a Dr. Eng. degree.

George W. Seymour, Chemical Engineer, Brunswick Pulp & Paper Co., Brunswick, Ga., a 1944 graduate of Kansas State College.

Harold A. Simons, Technical Director, Quality Control, Mutual Box Board Co., Utica, N. Y. Attended Columbia University.

Philip L. Slayton, Branch Sales Manager, Monsanto Chemical Co., Chicago, Ill., a 1944 graduate of Bowdoin College.

Francis J. Sloan, Research Div., Package Machinery Co., East Longmeadow, Mass.

Henry C. Smith, District Engineer, Fischer & Porter Co., Albany, N. Y., a 1951 graduate of Lehigh University.

Melvin W. Snover, Sales Manager, Williamson Adhesives, Inc., Skokie, Ill. Attended the University of Cincinnati.

Horace C. Swannell, Electrical Engineer, J. E. Sirrine Co., Greenville, S. C., a 1912 graduate of the University of Illinois.

Irwin L. Taylor, Supervisor of Quality Control, Detroit Sulphite Pulp & Paper Co., Detroit, Mich., a 1947 graduate of the University of Michigan.

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Charles R. Tittemore, Control Superintendent, Gaspesia Sulphite Co., Ltd., Chandler, P. Q., Canada, a 1942 graduate of the University of Saskatchewan.

Breckenridge K. Tremaine, Technical Representative, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., a 1927 graduate of the University of Delaware.

C. Tuiquez, Librarian, Fabrica Nacional de Moneda y Timbre, Madrid, Spain.

Edward T. Turner, Jr., Staff Assistant, The Gardner Board & Carton Co., Middletown, Ohio, a 1948 graduate of Cornell University.

Theo I. S. Vermeiren, Managing Director and President, Epuro, Inc., Antwerp, Belgium.

Thomas K. Wahlberg, Chief Chemist, Fiskeby Fabriks A/B, Skarblacka, Sweden, a 1950 graduate of the Royal Institute of Technology.

Frank D. Wallene, Vice-President in charge of Power Div., Meriam Instrument Co., Cleveland, Ohio.

Harvey K. Waters, Sales Engineer, Swenson Evaporator Co., Div. of Whiting Corp., Harvey, Ill., a 1948 graduate of Michigan College of Mining and Technology.

Joseph W. Wilson, Mechanical Engineer, Riegel Paper Corp., Milford, N. J., a 1949 graduate of Lafayette College.

TAPPI Notes

John L. Aldrich, formerly Captain in the Air Force, is now Chemist for Cellulose Fibres, Inc., Holyoke, Mass.

Kenneth A. Arnold is now Technical Director of the St. Regis Paper Co., Deferiet, N. Y.

E. Bache is now Assistant Superintendent of the Board Division of the Gaylord Container Corp., Bogalusa, La.

Edward C. Berg is now Product Development Director of Ace Carton Co., Chicago, Ill.

Walter C. Bloomquist is now Manager of the Industry Sponsor Unit, Industrial Engineering Section, General Electric Co., Schenectady, N. Y.

Russell Buck is now Superintendent of the Converting Div., Sorg Paper Co., Middletown, Ohio.

T. E. Button is now Sales Manager of the St. Regis Paper Co. kraft mills at Tacoma, Wash., and Pensacola, Fla. He is located at the New York City office.

L. Baxter Chamberlain is now Plant Manager of the Container Corp. of America, Wabash, Ind.

Joseph C. Clark, Jr. has been transferred from Big Island, Va., to Valdosta, Ga., as Assistant Superintendent of the Technical Dept., National Container Corp.

Thomas M. Cook is now Assistant Vice-President of W. R. Grace & Co., New York, N. Y.

John E. Cornell is now Assistant Superintendent of the Hammond Bag Co., Wellsburg, W. Va.

Donald W. Davis, formerly of the Marathon Corp., is now with Milprint, Inc., Milwaukee, Wis.

Walter Dempsey has been transferred from the Wheelwright, Mass, Div., to the Mt. Tom, Mass., Div. of Doeskin Products Co. as General Manager.

D. G. Driscoll is now President of the Sorg Paper Co., Middletown, Ohio.

Axel Ekwall, formerly of Embretsfos Fabrikker, is now Technical Director, Union Paper Co., Amot (Modum), Norway.

Myron Flotow is now Production Manager of the Mohawk Paper Mills, Cohoes, N. Y.

Donald D. Foster has been transferred from the Sumner, Wash., Div. of Fibreboard Products, Inc. to the San Joachim Div., Antioch, Calif., as Senior Chemical Engineer.

Carl G. Geijer, formerly of Fiskeby A/B, is now Sales Engineer of Nordiska Maskinfilt A/B, Halmstad, Sweden.

Fred J. Giffin is now General Manager of the Pulp Div., International Paper Co., Montreal, P. Q.

James J. Grovenstein, formerly of the Hudson Pulp & Paper Co., is now Process Chemist for Rayonier, Inc., Fernandina Beach, Fla.

George A. Hall, Jr., formerly of the Wyandotte Chemical Corp., is now Application Engineer for the Bristol Co., Waterbury, Conn.

S. E. Hazelhurst, formerly of the Weyerhaeuser Timber Co., is now General Superintendent of the Ketchikan Co., Bellingham, Wash.

Alfred M. Heald, formerly of the Scott Paper Co., is now in charge of the Research and Development Dept., Hollingsworth & Whitney Co., Waterville, Me.

Charles F. Hill is now Assistant Technical Director of the Sorg Paper Co., Middletown, Ohio.

Alfred W. Hoffman, formerly of the Container Laboratories, Inc., is now Quality Control Manager of the Robert Gair Co., New York, N. Y.

Eleanor F. Horsey, formerly of the U. S. General Services Administration, is now Administrative Chemist for the Diamond Ordnance Fuze Laboratory, Washington, D. C.

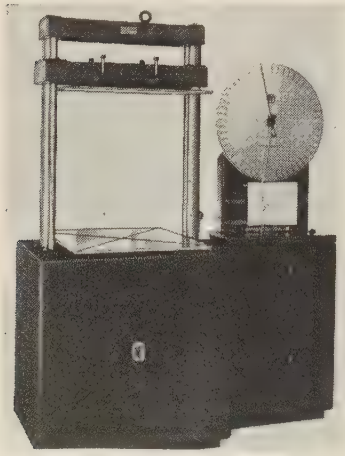
Theodor Kleinert, formerly of Zellwolle Lenzing A/S, is now a Research Associate at the Pulp and Paper Research Institute of Canada, Montreal, P. Q.

Harold W. Knudson, Technical Director of Hollingsworth & Vose Co., East Walpole, Mass., has been appointed a member of the Board of Directors of the Lowell Technological Institute, Lowell, Mass. Mr. Knudson, together with H. B. Parniele of P. Lorrillard Co., recently developed the "Micronite" filter for the new Kent cigarettes, manufactured by the H & V Specialties Co.

K. E. Kretlow, formerly of Wortendyke Mfg. Co., is now Superintendent of the General Waxed Paper Co., Chicago, Ill.

George E. Maltenfort is now Assistant Manager of the Central Laboratory of the Container Corp. of America, Chicago, Ill.

James W. McIntyre, formerly of the Munising Paper Co.



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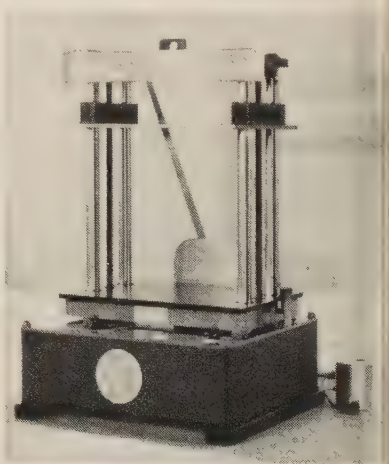

is now Chief of Converted Specialties in the Research & Development Laboratories of Kimberly-Clark Corp., Neenah, Wis.

Donald A. Pearson, Technical Director of the Ketchikan Pulp Co., has been transferred from Bellingham, Wash., to Ketchikan, Alaska.

William F. Scanlon, Sales Engineer of the Swenson Evaporator Co., has been transferred from Houston, Tex., to Philadelphia, Pa.

R. L. Schuerman is now Administrative Assistant for A. E. Staley Mfg. Co., Decatur, Ill.

Lester J. Smith, Resident Manager of the St. Regis Paper Co., Harrisville N. Y., has been transferred to Deferiet, N. Y.

Edward R. Stacy, formerly of the Stevens Paper Mills, Inc., is now Chemist for the Hurlbut Paper Co., South Lee, Mass.

George B. Stanton, Jr., formerly of the Arvey Corp., is now a Technical Salesman for the Rubber & Asbestos Corp., Bloomfield, N. J.

Howard W. Stephen, Chemist for the National Container Corp., has been transferred from Ontonagon, Mich., to Big Island, Va.

Murray M. Stokely is now a Partner in the J. E. Sirrine Co., Greenville, S. C.

Alexander Szware is now President of Cellulose Assets Development Co., Montreal, P. Q.

Raymond H. Taylor, formerly of the U. S. Army, is now Project Engineer for the Minnesota & Ontario Paper Co., International Falls, Minn.

Charles L. Wagner, Chemist for Marathon Corp., has been transferred from Menasha, Wis., to Rothschild, Wis.

George F. Waldhaus, Plant Chemist for Fibreboard Products Inc., has been transferred from Antioch, Calif., to Sumner, Wash.

Jack E. Weaver, formerly Technical Director of the Mohawk Paper Mills, Inc., is now with the Rochester Paper Co., Rochester, Mich.

R. A. Webber is now Administrator of the Research & Development Dept. of the Brown Co., Berlin, N. H.

William F. White, Sales Engineer for Oliver United Filters, Inc., has been transferred from New York City to Oakland, Calif.

Virgil O. Wodicka, formerly with Libby, McNeil & Libby, is now Chief of the Animal Products Div. of the Quartermaster Food & Container Institute, Chicago, Ill.

C. J. Yarber is now Manager of Production of the Chemica Paper Mfg. Co. and Crocker-McElwain Co., Holyoke, Mass.

Donald A. Yateman is now Paper Chemist at the Army Chemical Center, Maryland.

Frank Zeitlin, Research and Development Chemist for the West Virginia Pulp & Paper Co., has been transferred from Luke, Md., to New York City.

* * *

Jean Vilars, Director of the Research Laboratory of Papeteries Darblay, has been elected President of the Association Technique L'Industrie Papeterie, succeeding Pierre Champeux who died in October, 1953.

J. C. Alford, Vice-President and Technical Director, has succeeded *W. J. Alford III* as the official corporate representative of the Continental Paper Co., Ridgefield Park, N. J., in the Technical Association.

G. J. Schmitt has succeeded *K. G. Fraser* as the official representative of the Tasman Pulp & Paper Co., Ltd., Auckland, N. Z., in the Technical Association.

F. P. Mackinney has succeeded *E. P. McGinn* as the official representative of the Sandoz Chemical Works, Inc., New York, N. Y., in the Technical Association.

K. S. Ducayet, Jr., Vice-President and Secretary, has succeeded *Archer J. Scarfoni* as official representative of the Clark-Aiken Co., Lee, Mass., in the Technical Association.

M. T. Finn, Manager of Lumber and Paper Sales, has

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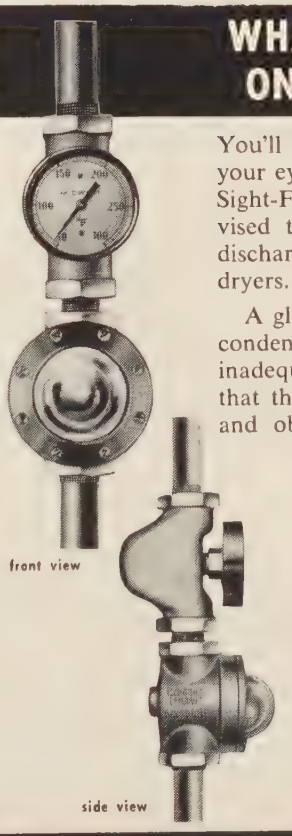

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succeeded *D. E. Putnam* as the official representative of the General Electric Co. in the Technical Association.

H. R. Chope, Sales Manager, has succeeded *Earl Slusher* as the official representative of Industrial Nucleonics Corp., Columbus, Ohio, in the Technical Association.

G. A. Hall, Jr., has succeeded *K. W. Peterson* as the official representative of the Bristol Co., Waterbury, Conn., in the Technical Association.

Seelye Stevenson Value & Knecht, New York, N. Y., has become a sustaining member of TAPPI. The firm is an outgrowth of the consulting engineering firm founded by Elwyn E. Seelye in 1912. In recent years, the facilities of the organization were augmented by the admission into the firm of A. Wilson Knecht, M.E., as a partner and Richard E. Dougherty, C.E., as consultant. It has been the practice of the firm to maintain a widely diversified engineering practice, including civil, structural, mechanical, and electrical work. As partners in the now dissolved firm of Myers and Addington, these men assisted such companies as the Union Bag & Paper Corp., the Camp Manufacturing Co., and the Gardner Board & Carton Co. in the development of economical utility systems.

Gould Pumps, Inc., Seneca Falls, N. Y., has become a sustaining member of TAPPI and will be represented by *C. L. Forshee.*

The DeZurik Shower Co., Sartell, Minn., has become a sustaining member of the Technical Association and will be represented by *David DeZurik.*

Industry Notes

Production

In November, mills continued to operate at near capacity rates, and despite a decrease in the number of working days due to the occurrence of Thanksgiving, produced an estimated 2,214,000 tons of paper and paperboard. While this was 8% less than the revised production for October of 2,408,657, which failed to quite equal the record output of May of 1951, it slightly exceeded the previous high for November established in 1950, when 2,195,467 tons were manufactured.

Although decreases in output were experienced by all of the major branches of the industry, the sharpest drop was registered by paperboard mills, as their production, exclusive of building board, was 1,021,000 tons, 10% less than in October but slightly higher than in November, 1952. The backlog of unshipped orders for board mills has continued to move downward from its September peak, and currently is about 440,000 tons, slightly less than at the same time last year when it was about 465,000 tons. The sharp decline in the backlog of orders since September is no doubt seasonal to a degree, but inventories at various distribution levels are also believed to be partly responsible.

Production of printing papers (book and groundwood), estimated to have been 312,000 tons, was only 9000 tons less than in October. The volume of new orders received by mills, although 40,000 tons less than in October, approximated shipments for the month. As a result, the total of unshipped orders for these two branches diminished slightly, the bulk of the decline occurring in book paper grades.

Fine paper mills with an estimated output of 106,000 tons for the month also continued to produce at a relatively high level. However, the trend in recent months of a declining volume of new and unshipped orders, and rising stocks on hand at mills, continued. At the close of the month unshipped orders were reduced from their October level by about 10% as they decreased to approximately 40,000 tons, equal to about 10 days' production. Stocks on hand increased to slightly more than 120,000 tons, equal to approximately 30 days' output

Wood Pulp

By the end of October, wood pulp production for 1953 had reached 14,674,000 tons, an increase of 946,000 tons over production for the comparable 10 months last year. Pulp production in October reached a record high of 1,578,000 tons.

Consumption of wood pulp also reached a new high in October, 1,693,000 tons, and for the 10-month period totaled 15,649,000 tons. This was an increase of 1,267,000 tons over the comparable months last year.

Imports of wood pulp continued high in October, and have averaged 181,000 tons monthly since the beginning of the year, as against a monthly average of 152,000 tons last year. Shipments from Europe totaled 459,000 tons by the end of October and from Canada, 1,346,000 tons.

Exports of wood pulp for 1953 through October totaled 116,000 tons, a decline of 72,000 tons under exports for the same months in 1952.

Inventories of wood pulp at the end of October were 636,000 tons, a decline of 30,000 tons under inventories at the end of September and a decline of 22,000 tons under inventories at the end of October last year. Pulp mill inventories were 140,000 tons and paper and board mill inventories 496,000 tons at the end of October.

Pulpwood

Receipts of pulpwood for the year 1953 through October totaled 23,264,000 cords, an increase of 325,000 cords over the comparable months last year. Domestic receipts increased 1,090,000 cords while imports declined 765,000 cords. Increases in total receipts were reported in the Appalachian, Southern, and Pacific States Regions ranging from 4 to 21%.

Pulpwood consumption for the 10-month period was 23,569,000 cords, an increase of 1,489,000 cords over consumption for the like period in 1952. Regionally, all but the Northeast showed increases ranging from 4% in the Pacific Region to 11% in the Southern Region.

Inventories at the end of October were 5,619,000 cords, a decline of 298,000 cords under inventories at the end of October, 1952. Nominal increases were reported in the Appalachian, Southern, and Pacific Regions.

Newsprint

Production in Canada (including Newfoundland) during December, 1953, amounted to 473,325 tons and shipments to 488,571 tons. Output in the United States was 89,656 tons and shipments were 90,240 tons, making a total North American production of 562,981 tons and shipments of 578,811 tons, compared with continental production of 550,036 tons and shipments of 546,071 tons in December, 1952. Total output in December, 1953, exceeded that in any December on record.

The North American output of newsprint paper in 1953 amounted to 6,805,278 tons, of which 5,721,296 tons—an all-time record—were made in Canada (including Newfoundland) and 1,083,982 tons in the United States. The Canadian mills produced 34,245 tons or 0.6% more than in 1952, while the output in the United States was 62,882 tons or 5.5% less than in 1952, thus the net continental decrease amounted to 28,637 tons, or 0.4%.

Stocks of newsprint paper at the end of December were 111,244 tons at Canadian mills, and 8,026 tons at United States mills, making a combined total of 119,270 tons compared with 135,100 tons on November 30, 1953, and 134,238 tons at the end of December 1952.

Wastepaper

When the Eastern wastepaper consumers shut down their operations for the celebration of New Year's Eve they had on hand the third largest tonnage of paperstock they ever had on a like date since the end of World War II. Their inventories of wastepaper had been increased 22.5% since the Fourth o

July, and were 4.6% greater than at the end of 1952; 16.3% greater than at the close of 1950. The tonnage on hand, however, was 22.4% below that at the close of that amazing year, 1951.

No records for wastepaper consumption were established in December, nor in purchases either for that matter. From November, the average weekly purchases dropped 13.8%; consumption 17.5%. Only once in December in the last 8 years—in 1951—was less wastepaper consumed and less wastepaper purchased. During the first 23 days of January, the average weekly consumption of paperstock ran 6.6% higher than the weekly average during the month of January in the previous 8 years, and the average weekly purchases of wastepaper during the first 3 weeks of January was 3.2% above that of the average weekly purchases of January in the previous 8 years. Wastepaper consumption by the mills of the East was at a higher rate during the first 3 weeks of 1954 than during any previous January since the end of World War II except one—and that one was 1951. During these 3 weeks it was 4% greater than the corresponding weeks of 1953 and 43% above the like weeks of 1952.

An announcement that may bring cheer to wastepaper packers has been made by the National Cash Register Co. of the marketing of a new type of paper from which copies can be made without the use of carbon paper. For years carbon paper that found its way into bales of wastepaper has plagued both the packers and consumers of paperstock. One sheet in a bale of wastepaper thrown into the beaters at the mills will seriously damage the furnish for making either new paper or board. While it may take a considerable length of time for the new treated paper to eliminate the use of carbon paper, it is a step that is expected to be appreciated especially by the packers who remove wastepaper from office buildings.

Industry Consultation on Foreign Loans

The administrator of the Business and Defense Services Administration of the Department of Commerce has stated that arrangements are being made with respective Washington agencies whereby industry will be consulted before commitments are made which strongly affect industry. The first arrangement to be concluded is with the Export-Import Bank. Whenever the bank is considering a project which will have a potential bearing on American industry, the bank will advise the Assistant Secretary of Commerce that it is considering extending a loan and would then discuss the project with the industry concerned.

Japanese Alaska Development

At a meeting of the Senate Committee on Interior and Insular Affairs held on Jan. 5, two industry members appeared as witnesses presenting industry's position as being against the proposed Japanese development in Alaska. The prime reason set forth was that such an arrangement would not be in the national interest since it was contrary to the long-range adequacy of our country's forest reserves as set forth in the Paley Report.

Austrian FOA Aid

Data received from the Foreign Operations Administration indicate that the Austrian pulp and paper industry has received about $28,000,000 in United States aid through Sept. 30, 1953. This aid has enabled Austria to double its prewar production through modernization of its principal mills and installation of faster machines. According to recent press reports from Washington, the FOA will not authorize further aid to Austria in the coming fiscal year, since Austria's economy has now reached a satisfactory level.

Paper and Raw Materials Imports

The value of imports of papermaking raw materials, paper, paperboard, and paper products for the first 9 months of 1953 and 1952, as reported in the monthly FT 110 reports of the Bureau of the Census for 1953 and 1952 is as follows:

	1953 (P)	*1952*	*Per cent change*
Total	$692,904,654	$679,838,442	+2
Pulpwood	24,613,936	36,963,626	−33
Wood pulp	197,239,228	198,892,465	−1
Rags, bags, grasses, etc.	3,295,898	5,640,143	−42
Paper	450,073,171[a]	426,092,220[b]	+6
Paperboard	11,265,880	7,446,985	+51
Paper products	6,416,541	4,803,003	+34

(P) Preliminary.
[a] Includes newsprint at $439,214,025.
[b] Includes newsprint at $418,894,456.

Canada

The past year has been a period of stability throughout the Canadian pulp and paper industry. The preliminary figures indicate that the over-all production of the mills, amounting to some 9.3 million tons, was almost 2% greater than the total output in 1952. Most sectors of the industry shared in this modest gain in production.

In expenditures on plant and equipment, pulp and paper was once again the leading single manufacturer in Canada. The industry spent $180 million last year on its plants of which $110 million was paid out for new construction, machinery, and equipment, and $70 million went for maintenance and repairs. Since the war, the industry has spent more than $1.1 billion on plant of which $675 million was paid out for new facilities, and $435 million for maintenance. Such expenditures have contributed very largely to the prosperity of Canadians during the last 8 years.

Once again, over the last 12 months our industry created more than $1 billion of new wealth for Canada and Canadians and, once again, Canada continued to lead the world in the total volume of pulp and paper exported. Exports both of newsprint and pulp were a little higher in 1953 than in 1952. The significant aspect of the export situation was that the underlying tone in the markets for both newsprint and pulp appeared to strengthen in the last half of the year.

Exports of other products of the industry, notably book and writing paper, fine paper, wrapping paper, and paperboard were again lower than in the previous year. This decline, though, was more than offset by the increased demand in the domestic market for these products which also strengthened as the year advanced.

While no new paper or pulp mills came into production during the year, there was, nevertheless, a sizable increase in the capacity of the paper mills and of the mills making bleached chemical pulps. Some facilities for the manufacture of unbleached sulphite and sulphate pulp were converted during the year to the manufacture of bleached grades.

Production

The preliminary 1953 statistics herein tell the story of the industry's performance during the year. For most grades of pulp and paper, production shows an increase over 1952. Pulp exports, representing 22% of the total output, increased by about 3% as compared with 1952. Newsprint production was also marginally higher than in the preceding year. And there was an upsurge in the output of practically all other grades of paper and of paperboard. Generally, the position of the industry appeared to have improved through 1953.

Newsprint

For the tenth consecutive year, Canadian newsprint production in 1953 reached an all-time record high. Output totaled 5.7 million tons, an increase of about one half of 1% over 1952.

World consumption of newsprint in 1953 continued to rise.

The distribution of the increase, though, differed somewhat from recent years. In the United States consumption increased by 2.6%, in contrast with comparatively modest gains of less than 1% in each of the two preceding years. Consumption overseas, as indicated by demand, also increased and at a faster rate than in the United States, but the apparent gain was about 4.4% compared with 6.5% in 1952. Canada's consumption increased by about 8%.

There was no evidence of any newsprint scarcity during the year. The Canadian mills again demonstrated their ability to meet a rising demand. They operated virtually at rated capacity and during the 12 months increased their capacity by 3.4%, or nearly 200,000 tons.

Principal Statistics

Preliminary 1953 Figures

	Production, tons		*Exports, tons*	
	1953	*1952*	*1953*	*1952*
Gross value of output	$1.1 billion	$1.1 billion	$876 million	$914 million
Total wood pulp	8,905,631	8,797,194	1,956,280	1,902,059
Dissolving and spec. chem.	454,158	405,254	410,527	357,693
Bleached sulphite paper grades	418,252	395,227	247,425	223,871
Unbleached sulphite	1,551,097	1,593,792	340,657	427,567
Bleached sulphate	601,109	532,144	522,038	460,427
Unbleached sulphate	593,012	547,690	170,162	144,151
Other chemical	122,495	105,802	34,457	28,704
Groundwood	5,065,114	5,102,300	222,309	248,802
Newsprint	5,721,296	5,687,051	5,334,287	5,297,681
Containerboard	371,744	341,873	24,572	27,045
Boxboard	367,633	345,686	25,760	39,312
Total paperboard	739,377	687,559	50,332	66,357
Fine paper	195,984	177,330	10,999	14,246
Coated paper	23,375	19,066	1,078	1,235
Other printing paper	54,348	56,822	30,685	31,223
Special papers	93,690	86,497	2,222	4,027
Wrapping paper	238,147	224,467	9,096	11,714
Bldg. papers and boards	193,000	185,638	4,000	5,763

There are some slight duplications in the foregoing figures. Some paperboard and wrapping paper is used by the mills for packaging. Coated paper covers a tonnage that undergoes a further processing after it leaves the paper machine and thus is also included under other grades. Total wood pulp production includes screenings, but excludes defibrated and exploded pulp. In addition to wood pulp, the industry uses annually some 450,000 tons of other stock in the manufacture of paper including about 362,000 tons of wastepaper, 40,000 tons of straw, 40,000 tons of rags and cotton linters, and 8000 tons of flax, leather, jute, rope, and other fibers.

Canadian shipments of newsprint to the United States in 1953 were some 26,000 tons higher than in 1952. This increase would have been considerably larger but for the substantial reduction which consumers made in their newsprint inventories during the year.

While consumption of newsprint abroad increased proportionately more than in the United States, Canadian exports overseas were approximately the same as in 1952, despite substantial gains in shipments to Britain. Overseas exports still lag behind the tonnage shipped both before the war and in the years immediately following it.

Research

Never in history has industry faced the kind of competition it faces today. Hitherto, the challenge came from competitors who put glitter or glamor into their goods or from individuals who developed a new method or a better product. Now the challenge comes from rapidly changing processes and products devised, not by some smart individual, but evolved by teams of patient scientists working away in laboratories which, unlike yesteryear, are no longer hidden away behind engine rooms or machine shops, but are now likely to be plant show pieces particularly on occasions when vainglory is permissible.

Because industry has shown what science can do—and vice versa—there has been a great up-surge in the volume of research and in the support given it by all industry. On this continent, private industry now spends about ten times as much on technological research as it spent in 1930; and the supply of technical men with postgraduate degrees of any kind is far below the number industry requires to keep in step with the progress of competitors and with the march of science in general.

Fortunately, our industry is generally alive to the importance of research. The Pulp and Paper Research Institute of Canada, the joint educational and scientific offspring of the industry, the Government of Canada, and McGill University, made satisfactory progress during the past year and has, I am glad to report, been placed on a basis that will permit it to continue to move forward with increasing momentum in the advanced training and the basic researches whereon rest the future progress and prosperity of our great industry.

The Forests

Owing to the vast strides that the industry has made since the war in scientific forest operations and in forest conservation, and because member companies generally now operate their woodlands to produce crops in perpetuity, both the Association and many of its member companies have sought to interest the public in the forest management methods pursued by the industry. As a result, there has been a most gratifying increase in public understanding of our forest and forestry operations.

In seeking to interest the general public in the forests, we have in some measure helped to create a useful array of amateur foresters. Naturally, a few of them have, at times, confused forest facts with forest fancies. Nevertheless we should continue, I believe, to inform the public regarding our woodlands operations because the future of Canada depends on the maintenance of the forests; and the forests cannot be adequately conserved and maintained without a knowledgeable public concerned with the future of Canada. In doing so, we should certainly not be on the defensive regarding our forest operations, our forest practices, and the fulfillment of our forest responsibilities. I believe that we may well proclaim the forestry progress we have made. We can be proud that we have spent more in conserving the forests than the owners, namely, all the provinces combined; that we operate our forests on a perpetual yield basis and grow more wood than we cut; that we have made the forests more valuable by developing more uses for wood species; that we are investing money on forest research and in growing trees on which we can expect no return for 50, 60, or 70 years; that we have helped to halt the budworm attack on thousands of square miles of Canada's forest; and that we have been largely instrumental in initiating a national Tree Farm program. And these are but the highlights of our forest program which has included, also, a better and more integrated use of the forest crop with logs being diverted to the purposes to which they are best suited, namely lumber, plywood, pulp, and other products; and the operation of mills using only sawmill waste as a raw material.

In the expanding forestry efforts of the industry, it is encouraging that both federal and provincial governments have joined with us in attacking basic forest problems. Several such industry-government undertakings are now under way. In Ontario, a research project on spruce regeneration was initiated in 1953 which the Premier described as "the broadest cooperative effort ever undertaken in Canada to conserve and increase the productivity of our forests." Another joint undertaking was conducted in New Brunswick where a budworm plague threatened to devastate vast areas of coniferous forests. Here four companies and the provincial and federal governments conducted a budworm blitz covering 2700 square miles of forest which were sprayed with insecticide at a cost exceeding $2 million. This attack on the budworm obtained a high degree of success. It will be renewed in 1954.

In Quebec, three companies and the provincial authorities plan to conduct a similar budworm operation in Gaspé and the Matapedia valley in 1954.

It is especially pleasing to report that there is a determination, extending throughout the industry, to protect and improve the yield of the woodlands. Progress in this area cannot be measured, yet there is a constant betterment in the industry's forest methods covering particularly, the means of making inventories and appraisals, the establishment of management units, and the orderly planning of operations for sustained and increased yield. All of which results from the development of studies and experiments in the forest. And in this matter, it is significant that individual companies set up at least four new experimental forests during the year where they are each conducting studies of forest management and operating methods.

The spread of forestry knowledge among private woodlot owners received great impetus with the launching last year of the national Tree Farm movement by the Canadian Forestry Association. This movement largely owes its origin to the work of the Woodlands Section of our Association and has as its objective the placing of most of the private woodlands on a sustained yield basis. It is in these private woodlots that the best forest oils are generally found and it is there that the most economical harvesting can be carried out.

The Tree Farm movement can eventually provide a larger annual pulpwood harvest available in close proximity to the mills. Hence the interest which many member companies have in it and the increased emphasis they are placing on it in their forest extension work.

The interest and momentum which the industry has developed in scientific forest management during the last eight years assures more abundant sources of raw material in the years to come and encourages all those who recognize that on the maintenance of the forests largely depends the future welfare of Canada.

by R. M. Fowler in "Annual Report of the President, Canadian Pulp and Paper Association, for the Year 1953."

Norway

The pulp and paper industry showed marked improvement during 1953. The immediate outlook is favorable, with full employment practically guaranteed for at least the first quarter of 1954. Prices have stabilized and in some sections of the industry, are above the January, 1953, level.

Philippines

A plan formulated for a Philippine pulp and paper project, envisions a yearly output of 61,500 tons from Philippine hardwoods. Production would include 16,500 tons of kraft linerboard, 14,500 tons of kraft bag and wrapping paper, 18,000 tons of newsprint, and 12,500 tons of printing and writing papers. Paper requirements, difficult to estimate because of restricted imports and inadequate statistics, are believed to approximate 90,000 tons a year. Local production in 1953 probably did not exceed 11,500 tons.

Sweden

The Skane Forest Owners Association plan to build a new semichemical pulp mill in Southern Sweden. The mill's capacity is planned at 17,000 tons per annum and will utilize hardwoods and such softwood unusable in present pulp plants and sawmill waste.

Pakistan

The new 100-ton per day paper mill, located 25 miles above Chittigong, is now in full operation. The plant erected at a cost of $16,000,000 and producing 30,000 tons annually, is expected to supply 75% of Pakistan's entire paper requirements. Pakistan was spending about $20,000,000 yearly on paper imports and the new mill is expected to save about $15,000,000 annually in foreign exchange.

Venezuela

A new paper plant is being constructed at Guacara, State of Carabobo, which is expected to be completed in April of this year. The plant will cost $900,000 and will utilize locally collected wastepaper and imported pulp. Paper napkins, kitchen towels, toilet paper, and paper are to be produced. The owners of this new enterprise are reported to have asked the Venezuelan government for import tariff protection on the products to be manufactured.

Japan

Press reports from Tokyo state the Japanese pulp makers oppose government views that manufacturing equipment is excessive and are set against government attempts to cut the supply of equipment funds to the pulp industry. The mills have been running at 83% of capacity, according to a recent official survey by the Japanese government's Ministry of International Trade and Industry. For 1954, it is reported that Japanese pulp producers are planning a production target of 1,800,000 long tons, compared with about 1,500,000 long tons produced last year.

Finland

Finland's ability to produce newsprint will be increased nearly 45% over the next 3 years, from 496,000 metric tons in 1953 to 716,000 in 1956–57, according to estimates of the Finnish Paper Mills Association.

As reported in the Jan. 4, 1954, issue of *Foreign Commerce Weekly* two large mills now under construction will provide 200,000 tons of the added capacity. One is expected to be operating by September, 1954, the other by the end of 1955 or early in 1956. New equipment being installed in two existing newsprint mills will give each an increased annual capacity of 10,000 tons by 1955. The association anticipates no difficulty in finding foreign markets for the increased output. It hopes to increase sales to the United States—now taking 140,000 tons annually—by 20,000 to 50,000 tons. Opportunities exist for larger sales to Western Europe, and for a considerable expansion in sales to South America and India.

China is considered an excellent potential market. Under current trade agreements, 1953 shipments total only 6000 tons, of Finnish newsprint annually.

Sales to Russia are expected to remain at the present level, about 10,000 tons a year.

A survey is being conducted to measure Finland's forest acres and results of the study are to be released in April. This is the third survey since 1921 and will provide Finland's cellulose industry with its first comprehensive forest picture since 1938. The forests are at present estimated to cover 53,500,000 acres.

Puerto Rico

Franklin R. Longwood, research forester, formerly with the Lake States Forest Experiment Station at Marquette, Mich., has spent a 6-week period at the U. S. Forest Products Laboratory, Madison Wis., in preparation for duties at the Tropical Forest Experiment Station maintained by the U. S. Forest Service at Rio Piedras, Puerto Rico. According to J. A. Hall, Laboratory director, Longwood will be in Puerto Rico for 3 years. His primary duty will be to provide information on Puerto Rican forest products to various industries recently established in Puerto Rico.

Part of his job will be to develop more effective methods of seasoning and finishing Puerto Rican woods and to select little-used species that might be utilized in fiber products. When necessary, samples will be sent to the Laboratory at Madison for test and analysis. Longwood will also set up

mill and factory tests to determine the suitability of these woods for furniture and for pulp products, such as wallboard.

Predicting Longleaf Growth

A simple method for predicting how fast longleaf pine will grow on different sites is described by D. C. McClurkin in Occasional Paper 132 of the Southern Forest Experiment Station, Forest Service, U. S. Dept. of Agriculture, 704 Lowich Bldg., New Orleans, La.

FAO Forestry Publications

Copies of three recent forestry publications of the Food and Agriculture Organization are available at FAO's New York Information Office, Room 372, at UN Headquarters. "National Forest Policies in Europe," a 370-page book, comprises reports received from member governments on policies, afforestation, and reforestation. An introduction discusses afforestation, increase of forest productivity, improvement of utilization techniques and more rational use of wood, organization of private forests, European production policy, and the place of forest policy within the general economic policy. "Research in Forestry and Forest Products" is a world directory of research institutions, with a summary of their activities. "Forestry Abstracts Coverage List" is a list of periodicals issued in various countries on subjects in the field of forestry.

Alabama Timber

Alabama has 20,756,200 acres of forest land that support 38.2 billion board feet of sawtimber. These findings of a new survey of Alabama's forests were released by State Forester J. M. Stauffer, Alabama Division of Forestry, and Philip A. Briegleb, Director of the U. S. Forest Service's Southern Forest Experiment Station at New Orleans. The survey is an activity of the Experiment Station.

In announcing the results of the survey, Mr. Briegleb pointed out that "completion of the huge timber census was advanced almost two years through generous cooperation from Mr. Stauffer's organization, the Tennessee Valley Authority, many members of the Alabama Forest Products Association, and other interested organizations."

Forests cover 20,756,200 acres of the State's total land area of 32,689,920 acres, the survey found. This is 10% more forest land than in the middle 1930's, when the first survey of Alabama's forests was made. The biggest increases in forest area occurred in the central and Piedmont counties. "This means," said Mr. Stauffer, "that we have almost 2 million acres more forest in Alabama to protect from fire and manage wisely."

Alabama's supply of merchantable timber, including cordwood size and sawlog size trees, totals 11.7 billion cubic feet. Of this total, the cubic volume of sawtimber trees, when converted to board feet, represents 38.2 billion board feet of lumber. The trees are chiefly the southern pines, oaks, gums, hickories, and yellow-poplar that help make Alabama the Mid-South's no. 1 lumber producer.

Since the initial timber census 17 years ago, the total cubic volume of all merchantable trees has increased 1%. The softwood volume (mainly pine) has decreased 5%, while the hardwood volume has increased 6%. For sawtimber trees alone, volume has dropped 17% in softwoods, 5% in hardwoods.

The serious decline in softwood was felt in all of the State except the Southwest region. There, private forest management has made great progress. In the Southwest, softwood sawtimber volume increased 16% in the 17 years between surveys. "The achievement of landowners and foresters in the Southwest region," Mr. Stauffer said, "is a challenge to all of us. The skill and foresight that brought about these results can do the same in the rest of the State." The survey also disclosed that Alabama's vast timber resource supports some 3000 sawmills, seven wood pulp mills, and more than 100 miscellaneous wood-using plants.

A full report of the Survey may be secured from the State Forester's office at Montgomery, or from the Southern Forest Experiment Station, 2026 St. Charles Ave., New Orleans 13, La.

AIM Awards

Eleven paper companies have been certified as "excellently managed" by the American Institute of Management, New York. Seven of them received the award for the fourth consecutive year: Crown Zellerbach Corp., San Francisco; The Champion Paper & Fibre Co., Hamilton, Ohio; Great Northern Paper Co., Boston; Marathon Corp., Menasha, Wis.; West Virginia Pulp & Paper Co. and St. Regis Paper Co., both of New York, and Scott Paper Co., Chester, Pa.

For the third time in as many years, International Cellucotton Products Co., Chicago, and Kimberly-Clark Corp., Neenah, Wis., received the AIM award, and the Brown Co., Berlin, N. H., obtained it for the second time. Olin Industries, Inc., was termed "excellently managed" for the first time by the Institute.

According to Jackson Martindell, president of the Institute, only 348 companies in the United States and Canada, out of the 3000 leading concerns whose methods were studied by that nonprofit foundation, were found eligible to receive the designation for the year 1953.

Ohio Pulp Mills

"Ladies, save your rags"! With this famous phrase, heard wherever pioneer papermaking was established, early Ohio saw its own paper industry founded. Rags were then the only available source of fiber. It was the true settler, the pioneer, who started papermaking in the State. By contrast, the Wisconsin and Michigan mills were started by industrialists after wood became known as a raw material. Rags were by no means plentiful and between 1810 and 1830 the existence of the industry was constantly imperiled by this scarcity. For this reason the earliest Ohio paper mills waged a constant and not always successful struggle for raw material. The mills made their plea for rags through advertisements in the limited newspapers of that period and on crude billboards, appealing both to the patriotism and the pocketbook. Much of the earliest part of the pioneer papermaking lore has been preserved in these forms. One such appeal is especially colorful:

> "Sweet ladies, please be not offended,
> Nor mind the jest of sneereing wags,
> No harm, believe us, is intended,
> When humbly we request your rags."

Much of the early industry was confined to the Cincinnati area for here was a logical center for rag purchase and paper sale. The first different fiber available was straw, use of which assumed considerable proportions after 1850. Straw was usually purchased from the farmer at about 1 dollar per ton. It was graded, first quality being rye, then wheat, followed by oats and barley. A surprising number of mills used straw pulp which they prepared themselves. Even fine papers were made from straw pulp, in desperation mixed with rags. Newsprint was frequently mixed half and half and this provides a valuable clue to the historian when dating old papers.

Wood pulp, both chemical and mechanical grades, came to Ohio during the sixties, although much experimental work and limited production were carried out 10 to 15 years earlier. In the interim period, between the time when rags became tremendously scarce due to constantly increasing production and when wood pulp became finally a commercial practicability, many attempts were made to reuse old printed papers. Three mills are definitely known to have tried to do just that. The Louis Snyder's Sons Co. in Hamil-

ton claimed to use 100% old paper and we made mention of this in the November article. Another mill was the Miami Valley Paper Co., in Miamisburg which later became George N. Friend mill No. 4 and still later was succeeded by the Miamisburg Paper Co. Following this it was operated by the American Envelope Co. of West Carrollton, and today is a division of Interstate of Middletown. This old Miami Valley Paper Co. used considerable portions of old papers in printing grades. It is reported that the shortage of pulp became so acute there at one time, that the superintendent (in desperation) gathered moss from the canal and dumped it into the beaters. He saw the "mottled" paper leaving his mill with mixed feelings, but was dumbfounded when the customer placed another order for this "attractive and unusual paper." Dumbfoundedness changed into consternation when he discovered that the spring floods had cleaned the canal of moss and he had to explain his "trade secret" to management, being unable to duplicate his great achievement.

Another mill which experimented with old paper pulp was the Beckett Paper Co. This mill was hit hard by the general shortages produced by the Civil War and began to experiment. Adam Laurie was superintendent and introduced the use of a mixture of old paper (newsprint to be specific). This was simply boiled with steam, in wooden tubs, equipped with mechanical agitators. When they had a few old books a small quantity of soda ash was used. Without washing or bleaching, the reclaimed stock was furnished directly to the beaters, together with the rag stock. The Cincinnati *Gazette* wrote to the mill: "Although we are glad to get the paper we prefer to do the printing ourselves."

When during the second half of the nineteenth century, wood finally became well established as a source of fiber, many mills in Ohio attempted to establish pulp mills. A large number of mills actually were successful for considerable lengths of time, but were defeated in the long run by the resulting shortages of forests and timber. The list of these pulp mills is surprisingly long. Lack of space limits us to mentioning only a few. One of the largest sulphite pulp mills in Ohio was the Alpha Fiber Co. in West Carrollton, a wholly owned subsidiary of the Friend Paper Co., predecessors of today's Oxford-Miami. Having started during the early eighties it produced 18 tons of dry pulp, was steam powered, and had five Friend-Stebbins digesters. By 1899 output had been increased to 22½ tons and after a tremendous modernization program in 1906, 150 tons were produced for a limited time. The pulp mill was discontinued shortly thereafter, however, because of previously unforseeable wood shortages and rising freight costs. The major portion of the wood had been obtained by rail from Canada, with a small amount furnished by local farmers.

The Hartje mill at Steubenville operated a groundwood mill during the nineties, to which a sulphite mill was added just before the turn of the century. They had eight grinders, three digesters, four wetlap machines and produced 30 tons each of groundwood and sulphite pulps. Franklin had a small soda pulp mill which was doomed to failure before it began. It produced 5 tons of soda pulp from 1889 to approximately 1895. Reference has been made to the Central Paper and Fiber Co., in Cleveland which "owned the Thompkins patent process" but we have not as yet been able to gather any information concerning either the mill or the process. In 1885 the Ohio Pulp Co. of Grand Rapids, Ohio, close to Bowling Green, was producing 2½ tons of pulp but this mill was, and continued to be, water-wheel powered even until 1902, and never achieved more than 7 tons with four grinders. The Mead Corp. began pulping operations early and is one of the very few successful Ohio pulping exceptions today.

—by Ernest F. Barker, in *Ohio Tappi*, Jan. 12, 1954.

Wisconsin

Wisconsin sulphite mills increased the use of sulphite roadbinder by more than 40% in 1953 over 1952, and almost doubled their 1951 use, the Lake States Roadbinder Association announced recently. Total quantities of spent sulphite liquor applied to road surfaces and thus kept out of Wisconsin streams was 43,800,000 gallons in 1953, as compared with 30,000,000 gallons and 23,000,000 gallons, respectively, in the previous 2 years.

"This utilization of sulphite liquor has been fostered by Wisconsin pulp manufacturers primarily to reduce stream pollution, and highway officials are adopting it so rapidly because they have learned from experience that where soil conditions are favorable it produces better roads at lower costs," said Walter A. Sherman of Park Falls, association president in releasing the 1953 statistics.

"More than 3000 miles of Wisconsin roads and streets are now economically kept in year-round smooth, dust free condition with regular use of sulphite roadbinder," Sherman continued. "It has been widely used for creating better subsurfaces on which to build blacktop roads, for reconditioning worn-out blacktop, and for miscellaneous tasks including parking areas, drive-in theaters, automobile racetracks, and stabilized road shoulders.

"All of these uses are growing steadily," Sherman concluded "There is every reason to expect that next year's use of sulphite roadbinder will exceed 60,000,000 gallons in Wisconsin, and that sulphite stream pollution will be accordingly reduced by this process."

Degradation Effects of Museum Light Sources

Useful information regarding the deteriorating effects of modern light sources on museum specimens has resulted from a study made by D. B. Judd of the National Bureau of Standards for the New York Metropolitan Museum of Art. On the basis of NBS data on the photochemical deterioration of cellulose, the Bureau has estimated the radiation hazard for six light sources commonly employed in museums and has made similar estimates for each of these sources in combination with protective filters. The results indicate that the cool-white fluorescent lamp, when used with a suitable ultraviolet-absorbing filter, combines excellent color rendition, approaching that of daylight, with low radiation hazard.

Radiant energy from light sources gradually embrittles paper, crumbles textiles, and fades the colors of pigments and dyed fibers. This photochemical action is especially marked for sources such as fluorescent lamps which emit appreciable ultraviolet radiation in addition to visible light. However, until comparatively recently the incandescent lamp was virtually the only source of artificial light considered for museums, and the problem of radiation hazard from artificial lighting was never a serious one. Then, with the development of various kinds of fluorescent lamps, high levels of artificial light became economically feasible, and color rendition approaching that of natural daylight could also be obtained. As a result, modern museums must seek a suitable compromise between the high level of daylight-quality illumination desired by present-day viewers and a kind of lighting long accepted as involving negligible radiation hazard but yielding inferior color rendition.

The Bureau's work on this problem was largely an extension of a study conducted in 1951 for the Library of Congress to provide recommendations for the protective lighting of the Declaration of Independence and the Constitution of the United States. The earlier study revealed that damage to documents of this kind is caused largely by ultraviolet, visible violet, and visible blue radiant energy on the photochemical decomposition of low-grade paper was utilized to set up an arbitrary scale of the relative damaging effect of different wavelengths from 365 to 546 millimicrons. On this basis a suitable light source and filter for the lighting of the historic documents were selected.

In the present investigation the scale of relative damage as

a function of wavelength was extended to cover the wavelength range from 300 to 640 mmu. Relative damage rates above or below this range are of no interest in museum lighting because none of the sources used emit appreciable damaging energy at wavelengths outside this band. To estimate the radiation hazard associated with a particular source, a probable rate of damage per footcandle was computed for each of six light sources commonly used or considered for museum lighting. This quantity was obtained as the ratio of two sums: $\int_0^\infty$ for $\sum_0^\infty H_\lambda D_\lambda \Delta\lambda / \int_0^\infty \sum_0^\infty H_\lambda \bar{y}_\lambda \Delta\lambda$, where H_λ is the spectral irradiance (areal density of radiant flux) of the light source at wavelength λ, D_λ is the relative damage factor, $\bar{y}_\lambda$ is the luminous efficiency of the source at the various wavelengths, and $\Delta\lambda$ is the interval (here 20 mmu) between the wavelengths at which H_λ, D_λ, and $\bar{y}_\lambda$ are evaluated. The sum in the denominator is thus the illuminance (areal density of incident luminous flux) in footcandles.

The six sources were zenith sky, the sun, the cool-white deluxe fluorescent lamp, the warm-white deluxe fluorescent lamp, the daylight fluorescent lamp, and the incandescent lamp. The Bureau also determined the distribution of irradiance which resulted from screening each of these sources with typical filters cutting off the short-wave portion of the spectrum to various degrees.

Of the filters studied, those like Noviol O yielded the smallest estimates of radiation hazard. Although such filters are slightly yellowish, the small distortion in color rendition introduced by them would probably not ordinarily be objectionable. However, filters like Greenish Nultra introduced no significant color distortion and still reduce the radiation hazard almost as much. In fact, the cool-white deluxe fluorescent lamp screened with Greenish Nultra is estimated to have a radiation hazard less than that of the bare incandescent lamp, which is generally admitted to be negligible. Yet the cool white lamp with this filter gives excellent color rendition while the bare incandescent lamp is relatively poor in this respect.

Stream Pollution

Legislation

Two bills dealing with stream pollution have been introduced thus far during the 2nd session of the 83rd Congress. These are:

H.R. 7168—Introduced by Bailey, Jan. 14, 1954. (Referred to Committee on Public Works.)

Authorizes an appropriation of $40,000,000 a year to the Department of Health, Education and Welfare for each of the fiscal years during the period July 1, 1954, to June 30, 1959, for making loans under section 5 of the Water Pollution Control Act.

H.R. 7170—Introduced by Bailey, Jan. 14, 1954. (Referred to Committee on Ways and Means.)

Provides that any person who constructs or erects an industrial waste treatment facility, shall be entitled to a deduction with respect to the amortization of the adjusted basis of such facility based on a period of 60 months. (This is similar to the accelerated amortization bills introduced in previous congressional sessions.)

Research

Extensive experiments conducted by the State of Washington, Department of Fisheries, on the effect of spent sulphite liquor on salmon of various species indicate that in excess of a 500 p.p.m. concentration of 10% solids, liquor is required before any toxic effects are evident, even after long periods of exposure. Some species such as the pink salmon survived concentrations in excess of 1500 p.p.m. at the time of migration into salt water. The effect of exposure to high liquor concentration is, under some conditions, delayed and appears only after the fish have been placed in liquor-free water. These and similar studies are reported in Research Bulletin 1 which can be obtained from the Washington Department of Fisheries, 1308 Smith Tower, Seattle, Wash.

Fresh, warm water fish survived dissolved oxygen concentrations of 2 p.p.m. for periods up to 6 days at 12°C. according to experiment studies conducted by the Aquatic Biology project of the National Council for Stream Improvement directed by Willis Van Horn at the Institute of Paper Chemistry. Survival time at this oxygen level decreased as the temperature increased. However, at temperatures as high as 24°C., fish showed no untoward effects at a dissolved oxygen concentration of 3 p.p.m.

Research on possible recovery value of sludges obtained from the primary treatment of deinking waste has been reported by Western Michigan College. This project was supported jointly by the Kalamazoo River Improvement Co. and the National Council for Stream Improvement. It was under the direction of A. H. Nadelman, Head of Pulp and Paper Curriculum. Possibilities for the manufacture of lightweight aggregate and filler for paper, rubber, asphalt and other products were explored at considerable length.

Through the cooperation of Southland Paper Mills, Inc., pilot-plant studies on the thickening of sludge produced by the treatment of kraft mill effluents with lime for color reduction are underway. The method under test is a carbonation and heating process developed by W. A. Moggio at the Council's Louisiana State University project. Laboratory tests have indicated that the hydrous sludge obtained from treatment could be concentrated to consistencies in excess of 10% by this technique.

Nepco

Rough handling of cars in transit to a customer sometimes results in damaged paper. For the most part the damage has been limited to the Chicago-St. Louis and eastern coastal areas. While there is little Nepco can do to control handling by the railroads, we are doing everything possible to see that shipments are properly loaded and braced.

The latest step in our continuing efforts to protect customer shipments was a recent survey of loading and shipping operations, in cooperation with Acme Steel personnel, from whom we purchase banding steel used in skid packing and loading procedures.

This survey has provided us with valuable information concerning various loading methods, a combination of which is being adopted by Nepco. As the need develops, the best methods will be standardized.

We are always interested in reports from the field concerning our shipments. The best aid is an inexpensive snapshot plus a reasonable explanation describing damage. This will give us the information which may spell the difference between success and failure on succeeding shipments. Any questions which may arise will be given prompt attention and constructive criticisms or suggestions are always welcome. The following description of various loading techniques in use by Nepco will help give the readers of this magazine an understanding of some of our problems as well as what results our efforts have obtained:

1. Solid or Through Loads. In this method of loading the car is filled solid throughout its entire length, including the doorway.

2. Rigid Braced Load. In this method, some or all of the load in each end of the car is rigidly braced to the car with wood which, in effect, makes the load part of the car.

3. Anchor Braced Load. This method utilizes steel strapping, and quite often wood gates, to fix the load in position in the ends of the car. The steel strapping is threaded through and wrapped around anchor plates which are then securely nailed to the car wall posts and/or car floor. The

method utilizes the resiliency of the steel strapping to lessen the shocks to the lading.

4. Semifloating Loads. (a) Controlled Load (sometimes called the brakeman method): this impedes or retards the the shift of the unit. Encircling bands around the units in each end of the car are threaded through Controlades. The Controlades are nailed to the car wallposts or car floor. Any shift of the load forces the encircling strap to be pulled through the Controlades which offer high resistance against shift.

(b) Vertical Anchor Method (floor anchored load): Pairs of steel strapping, extending in opposite directions from anchor plates secured to the car floor are joined in a vertical plane around the unit. Any shift of the load must then occur within the loop of the strap. The amount of shift is reduced by the friction of the strap being forced to go around the corners of the unit.

(c) Snubbed Vertical Anchor Method: This is similar to (b) but each anchored band makes a complete wrap around the first one or two skids in each row. This materially increases the resistance against the shift.

5. Floating Loads. Under this method the lading in each end of the car is confined by light wood gates and securely strapped by encircling unit-load bands. These may be either in a horizontal or vertical plane or both.

Clear floor space at each end of the car, say 24 to 36 in. as well as clear doorway space, is desirable for this type of load.

The advantage of this type of load is that on impact the self-contained units can move, thus dissipating the shock of impact throughout the friction exerted against the floor of the car. This method is being used on a trial basis on shipments to trouble areas.

Jumbo Roll Loading

We prefer to load jumbo rolls on their ends wherever possible. This allows a good, solid pack across the car; it also places the roll on the flat surface, thus eliminating the tendency to roll. Any of the five methods previously described can be used for bracing this type of load. Here again it can be readily understood how the friction of the flat surface of the roll across the floor will assist in dissipating the shock of impact when cars are coupled.

Rolls loaded on their sides present a greater problem and in general are more susceptible to damage in transit than those loaded on their ends. This type of load, of course, must be confined to both ends of the car, with the doorway left open. The rigid or anchor brace methods may be used to secure the rolls in the ends of the car. Toeblocks can be successfully applied on the bottom tier when this method of loading is used.

The principal objection to the use of toeblocks is that if one should fail, and they do, it is apt to leave exposed spikes in the floor of the car, which can do considerable damage by gouging the rolls. Also, when cars are coupled at excessive rates of speed rolls will frequently jump the toeblock, which again is apt to produce a certain amount of damage. The point here is that a steel band can fail as well as a toeblock and thus allow a batch of rolls freedom to move in the car. However, the failure of the band in itself ordinarily does not produce an additional hazard as in the case of a toeblock failure. We have used toeblocks with a reasonable amount of success in combination with rigid and anchor braced methods. Our jumbo roll damage has been reduced considerably since we stopped loading rolls three tiers high on their sides. We still will have a number of customers who insist that rolls be loaded on their sides because their own facilities for unloading are limited, but we keep the load down to two tiers high.

Counter Roll Handling

Counter rolls are loaded in tiers across the width of the car. In the past when we have loaded solid cars, including counter rolls, those in the doorway were placed in tiers parallel to the side of the car. This is to avoid having the rolls roll against the doors and jam.

We have had a few incidences where counter rolls loaded in the doorway have been crushed through rough handling by the railroads. On impact the load in the end of the car is forced against the sides of the rolls loaded in the doorway, which in a sense acts like a battering-ram against these rolls, thus causing the damage. For reasons of economy we load counter rolls solid through wherever possible; however, if any appreciable amounts of damage in transit develop in the future, we will have no alternative except to modify our present method of loading 9-in. counter rolls.

For stopover cars we must use the rigid bracing method to hold freight for each stopover point. Railroads have done a certain amount of work to get stopover points to level off the load when their lading has been removed. This would appreciably reduce the possibility for damage through the remainder of the trip.

Skid Damage Lessened

Skid damage has materially diminished since we adopted a newly designed skid. When loading skids in a car we use the vertical anchor or snubbed vertical anchor method of bracing. Runners are braced by nailing a 1 by 6-in. board across the runners. Both of these methods allow the shock of impact to be distributed throughout the entire load and dissipated through the retarded movement of the skids. On Government skid orders we use their skid specifications. The method of loading in the car is very much the same except for minor details.

It has been reported that some railroads couple cars at speeds up to 8 or 12 miles per hour. This imparts a tremendous shock to the lading in the car, and has resulted in cases of damage for our customers. The resulting claims frequently run into sizable figures and tie investments up for long periods of time before final settlement is made. We have been informed that as a rule these claims are accepted by the railroads without much trouble; however, from the standpoint of service to our customers we want to minimize the necessity for such claims wherever possible.

The added expense in labor and material required to do this is in a sense a direct responsibility of the railroads. For the present this increased cost will apply to the trouble areas only, pretty much on a trial basis. We do not plan to adopt costly loading methods in areas where past experience has not demanded it.

—by Lawrence E. Bandt, in *Nepco News*, January, 1954.

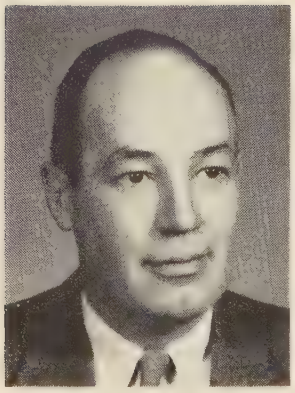
UNION BAG

Georgia's 4-H clubs will have a forestry education and demonstration building at their new state center at Rock Eagle Park. The construction of the building has been made possible by a $25,000 grant from the Union Bag & Paper Corp. and an equal amount from the State of Georgia. The new structure will house forestry equipment that will be used by 4-H'ers in studying up-to-date methods of conservation and woodland management.

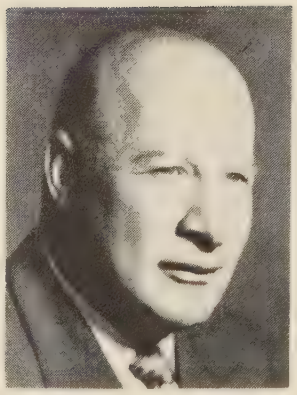
The Georgia Forestry Commission will "custom grow" pine seedlings for Union Bag & Paper Corp. The firm will furnish pine seed which will be planted in the commission's nurseries. The seedlings thus grown will be returned to Union Bag for planting in the localities from which the seed was gathered. Seed will be collected from dominant trees to assure superior planting stock. Cost of the project, in which 6,500,000 seedlings will be grown, will be borne by the company.

MEAD

George E. Brombacher, Jr., has been appointed director of purchasing for The Mead Corp., D. F. Morris, first vice-president, announced recently. Mr. Brombacher has been active in corporation purchasing since 1952, and is responsible for the



G. E. Brombacher, Jr., The Mead Corp.



William Mazer, Hudson Pulp & Paper Corp.

negotiation of purchase contracts for wood pulp, heavy chemicals, and major items of supplies and equipment which require central handling, except pulpwood, timberlands, and real estate. Purchases of materials and supplies for the company's various divisions will continue to be handled by local purchasing agents as in the past. A new pulp mill capable of using oak has been put into operation at Chillicothe, Ohio, by The Mead Corp. The new mill will provide a market for oak timber produced by tree farmers in the region and also will utilize aspen, willow, cottonwood, yellow poplar gum, and other species.

Hudson

William Mazer, executive vice-president of the Hudson Pulp & Paper Corp., has been named a member of the board of trustees of Brandeis University in Waltham, Mass., it was announced by George Alpert, trustee chairman.

A graduate of New York University, Mr. Mazer has been with his present firm since 1927, and has served as executive vice-president since 1947.

At present 867 young men and women from 31 states and eight foreign nations are enrolled as undergraduates, and 40 students are enrolled in the University's new Graduate School of Arts and Sciences. Here courses are offered in chemistry, musical composition, Near Eastern and Judaic studies, and psychology.

MacMillan & Bloedel

Company forester Ian Mahood has volunteered to take readers on a verbal "bus-ride" along the high-roads and low-roads of MacMillan & Bloedel's Beaufort Tree Farm. The farm is a 24,762-acre tract of tree-covered land running alongside the Beaufort Range of mountains and to the west of the Vancouver Island communities of Fanny Bay and Union Bay. The land covered by the farm is rugged. It contains deep ravines, rushing rivers, snow-fed lakes, and very few level spots. But it's a dandy site for growing British Columbia's most important crop—trees. The soil is thin and sparce, yet fine stands of trees are growing. They get most of their nourishment from the sun and elements of the air.

Along the route to be traveled are seven location markers. At these points the people on the tours usually disembark, but because this trip is a condensed version of the real thing we'll have to remain seated. Meet Ian Mahood, your host:

"Here's the first stop and we are up by the headwaters of the north branch of Cougarsmith Creek. You're probably thinking that this 20-acre area which was logged and burned in 1948, looks black and barren.

"Right at your feet are yellow stakes, pegged seemingly at random. Each marks a 2-to-4-in.-high tree about 2 years old. This logged-off area which at first glance looks barren, actually averages 1500 little trees to the acre. The planting job was done in nature's competent way—by seed winging through the air from large trees on the rim of the patch. It'll take 3 to 5 years before this new forest will show itself above the fireweed and tree stumps.

"Now let's move on to the second location . . higher up the mountain slope . . . "Here's an area that was logged and burned about 1947 as part of a big skidder setting. Notice that the ground is steep and faces south, receiving the sun's rays at a 90-degree angle. Seed trees were left behind by the loggers but natural new growth hasn't come in. Without shade and moisture during a long dry spell after the seed germinated, the newly sprouted seedlings lost their battle for existence.

"To put new life into the area we plated 180,000 healthy 2-year-old trees earlier this year. You'll note that the trees have been planted in rows about 6 ft. apart and that there are about 800 trees to the acre. Policy today is to log in smaller patches and minimize slash-burning. As a result problem areas like this are no longer numerous and hand-planting will remain a small part of the reforestation program.

"From here we'll now go back to the main highway and up along the T'Sable River west of Buckley Bay.

"We are now about 5 miles off the Island Highway in an area that was logged by railroad skidders in big settlings which made it difficult to preserve seed trees, so it was necessary to resort to costly hand planting after logging. Here, the company planted more than a million 2-year-old trees. Look at them now . . . a lush green forest 5 to 10 ft. tall. Notice the number of 8 to 10-ft. trees showing up in a regular pattern over the face of the area. These are the strong trees gaining dominance in the severe competition for survival. The weaker trees will die in the course of the crop cycle and in the end the original 800 per acre will shrink to a mere 35 to 40 crop trees.

"But let's go on farther up the road.

MacMillan & Bloedel, Ltd., Harmac, B. C., puts the squeeze on its bleached sheet sulphate pulp for wrapping and binding with this 800-ton, Baldwin-Southwark self-contained hydraulic press

"Here's an area of natural reproduction. All these trees—about 2000 to the acre—developed from that lone seed tree standing on the ridge. You see, a good seed tree can produce up to 100,000 seeds in a good year. Unfortunately it only bears seed in irregular cycles 3 to 5 years apart. The young trees you see are 10 years old, the same age as the planted ones down the road. But instead of only 800 trees to the acre as in the plantation there are 2000 here, and note they are double the height of the others. That's because the greater density of trees here has stimulated their growth by forcing each one to reach up for sunlight. This is why foresters attempt to get natural regeneration wherever possible.

"Just around this next bend is an area containing 18-year-old trees, all seeded in naturally. See the 30-ft-high crop trees? They're 6 to 9 in. on the butt, a size that in some parts of the world is harvested for pulpwood . . .

"Now back to the Island Highway and Union Bay . . . where we turn in to the forest once again.

"Here we are in a new forest in an area that was logged back in 1918. Already the crop trees are 50 to 60 ft. high and 18 in. and over on the stump. Beside each of the large trees are smaller ones. Look, here's a 20-in. tree with a 6-in. neighbor. You won't believe it but both trees are the same age, 35 years old. To prove it I'll use this increment borer, take out a core of wood and count the annular rings. . . .

"Quite an eye-opener isn't it?—that the big one could grow so big in 35 years; and that from an identical start the small one right beside it should be so small by comparison. (The merchantable wood in the big one is more than 15 times as great as in its small neighbor.) It is evidence of the competition for survival which began in the seedlings we saw at the beginning of this trip. In advanced young growth such as this 35-year-old forest, our future plans call for periodic thinning of the weak trees. These will be converted to pulp in an effort to recover some of the natural wastage of wood in the growing forest.

"Here's our last stop. Langley Lake is just a stone's throw south of us. The trees you see around us are 74 years old. Almost all of them are over 100 ft.—or the height of a 9-story building, and they're up to 30 in. on the stump. From these can be made plywood, lumber, and pulp.

"Well you've seen it all, from landscapes filled with 2-year-old seedlings to trees that are ready for the harvest. And you can see that by developing a succession of age classes up to 70 years we are able to create a sustained crop production. We'll keep the succession coming by reforestation, fire protection, and management of the land."

Consolidated

One fourth of all spent sulphite liquor produced in its Wisconsin Rapids pulp mill is now being used to test a soil filtration process for reducing sulphite stream pollution, Consolidated Water Power & Paper Co. announced recently.

"If the experiment turns out satisfactorily, all the mill's sulphite liquor may eventually be pumped to large filtration beds and processed by this method before release to the Wisconsin River," G. K. Dickerman, company technical director, stated.

During the past Summer a system of four soil filtration lagoons was constructed on a tract of riverbank land 2 miles from the company's big mill. Tank trucks haul hot liquor from the mill to these lagoons. To reach the stream, lagooned liquor must pass through many layers of sandy soil. While it is thus underground, natural biochemical activity in the soil consumes much of the liquor's wood sugars which otherwise would use up oxygen in the river water.

Constant laboratory testing of the effluent indicates that soil filtration reduces the oxygen demand of the spent liquor by a substantial amount, Consolidated's technical staff reports by the time it reaches the stream, the liquor has lost much of its "strength."

For even closer study of soil filtration, Consolidated scientists have made a pilot-size unit in the mill itself. Here spent liquor is dripped at a controlled rate upon a bed of soil 10 ft. deep. Oxygen demand of the liquor is periodically analyzed as it enters at the top and again as it emerges from the bottom. By varying the conditions in this test unit, the technical men hope to learn how to make the soil filtration process increasingly effective.

Burning of spent sulphite liquor that formerly flowed into the Fox River from Consolidated's Interlake mill is now proceeding at full capacity. The mill installed an evaporator plant about 9 months ago at a cost of more than $600,000, to rid sulphite liquor of excess water so that the liquor could be used for industrial fuel. But burning the concentrated liquor efficiently proved harder than expected, and Interlake's two big specially designed liquor furnaces were able to operate only spasmodically for many months.

Modifications completed recently have turned out satisfactorily, according to L. E. Smith, mill manager. Both furnaces now run to design capacity without interruption and the by-product fuel they use replaces, though at a somewhat higher cost, a good many tons of coal that otherwise would have been needed.

Warren

The S. D. Warren Co., Cumberland Mills, Me., has made available one of its logging operations to the University of Maine, Experiment Station, where a study is under way to develop hardwood volume tables. The company will collect the field data and the forestry department at the University will analyze it and construct the volume tables.

St. Joe

Florida has the largest Tree Farm in the nation. The record-breaking Tree Farm of 800,000 acreas is owned by the St. Joe Paper Co. and is located in 12 counties. Texas held claim to the honor before dedication of the St. Joe property.

Bergstrom

A new Bergstrom Retirement Plan was announced to all present and retired company employees the last day of 1953. An expert from the consulting firm hired by the company to set up the plan spent two days during the last week of December explaining the plan to all present employees.

The company pays the entire cost of the retirement plan (as well as half the tax for each employee's Social Security).

The money for the plan is deposited with the Harris Trust and Savings Bank of Chicago as trustee. The trustee invests the money and sends out the monthly checks to retired employees or their beneficiaries. Employees become entitled to their portion of this fund when they individually have met the eligibility requirements of the plan upon retirement. Bergstrom Paper Co. is entitled to no return of any portion of this trust fund. The trust fund established for the purposes of this plan belongs to the men and women covered by the retirement plan.

Andrews

H. P. Andrews Paper Co., 14 W. 3rd St., New York, N. Y., has started publishing *Reproduction Paper News Bulletin*, planned for publication at least 6 times per year. Andrews will be glad to send this bulletin to anyone who requests that his name be placed on the mailing list.

West Virginia

There exist in wood a number of chemicals other than the cellulose which is used in papermaking. An important aspect of West Virginia's operations has been the successful development of uses and markets for these other elements of wood which were once regarded as waste material.

The Industrial Chemical Sales Division, established as early as 1912, markets activated carbon, tall oil, and crude terpenes.

Efforts in the field of activated carbon have made the company the world's largest producer of this chemical, which is now widely used in a number of grades as a purifying medium by municipal water systems, and by the sugar, food, and pharmaceutical industries for the same purpose.

Other chemicals sold by this division include various grades of tall oil for use in the paint, varnish, soap manufacturing, and floor covering fields, and crude terpenes which are sold for use in insecticides.

The Polychemicals Division was formed this year to provide an integrated organization to broaden the commercialization of lignin products. Lignin, which has been produced on a semicommercial basis by the company for a number of years, has been used with success in the manufacture of asphalt emulsions and in dye application processes, and shows promise in certain types of rubber manufacturing.

Facilities for the production of these chemical products include the recently expanded carbon plant and the tall oil refinery at Covington, and the lignin plant and installations for the production of crude tall oil and crude terpenes at the Charleston plant.

HOWARD

On January 9, the Research and Technical Control Division of Howard Paper Mills, Inc., moved into new and larger quarters in space recently erected at the Aetna Paper Division mill in Dayton, Ohio. K. P. Geohegan, director of the

Gathered for a regular group conference in the new Howard laboratories are: Margaret Steele, secretary; L. M. Tyler, chief chemist; F. L. Kimmel, manager, Aetna Division; K. P. Geohegan, Director, research and technical control; K. M. Grasse, research chemist; and E. W. Petrich, chemical engineer. Additional personnel not shown includes C. E. Brandon, assistant technical director

Department of Research and Technical Control, and former president of TAPPI, calls the new laboratory, "one of the most modern in the industry," pointing out that enlarged facilities and new equipment are part of the long-term improvement and expansion program affecting all Howard divisions.

The laboratories are located on two floors; in addition to an unusually large accurately controlled humidity room, each floor has an individual air conditioning system. In addition to general paper research, and new product development, the laboratories supervise all quality control over pulp supply, rag supply, paper in production, and finished paper. Control tests at the paper machines are also reported to the laboratory. Further, the Dayton operation serves as central laboratory for all Howard mills, supplementing the separate laboratories maintained at the Howard Paper Division in Urbana, Ohio, and the Maxwell Paper Division, Franklin, Ohio.

View of new 14 by 30-ft. humidity room. Shown, left to right are: Margaret Steele, using Bekk smoothness tester; Edward W. Petrich, using G. E. brightness tester; Nancy Schumacker, checking caliper; Kenneth M. Grasse, checking folds on the M. I. T. folding tester

Visitors to Dayton, interested in the most modern techniques and facilities for research and technical control, are invited to tour these new laboratories.

K-C (MUNISING)

If it takes wood and water to make paper, you can see at a glance why Munising is a paper town.

At its front door is the great, blue expanse of Lake Superior, with its clear, clean, cool water. All around the town, covering the row of protective hills that surround it to the east, south, and west, is a thick vigorous forest growth. Here are found all the types of forest land of the Lake States, with spruce, balsam, hemlock, cedar, and pine growing plentifully in the softwood stands, and poplar, maple, birch, elm, and beech in the hardwoods.

And as an important by-product of the location, the Munising mill nestles right on the waterfront of Munising Bay, said to be the finest natural anchorage on all the Great Lakes and offering the mill a water highway not only to the coal

View of Howard Pulp Testing Laboratory with James W. Gibson taking sample of pulp from Noble & Wood beater preparatory to making handsheets. Also in view, laboratory rotary for cooking rags for experimental purposes

fields of the East and the forests of Canada, but actually to nearly any seaport in the world.

The town and the mill are surrounded by magnificent scenery—it is one of the northern Michigan localities that seems to be growing fast in popularity as a resort area and one which will beckon more and more to travelers seeking natural woodland beauty, the attraction of mighty Lake Superior, or the sparkling, pollen-free Summer atmosphere.

The Munising mill, though a latecomer to the K-C family of mills, has been producing paper for a long time. It celebrated its 50th year in 1952—its first year as a Kimberly-Clark subsidiary.

History

The paper industry didn't lead the way in this town, as it has in many other Northern communities. It tagged along lumber, leather tanning, and mining opened the door, and it actually owes its beginning to a peculiar combination of events.

Munising, prior to the turn of the century, was surrounded by vast areas of land wooded with hemlock trees. In those days, with white pine and other desirable tree species so plentiful, the lumbermen weren't much interested in sawing hemlock lumber. On the other hand, the hemlock bark was needed for tanning of hides, and the plentiful supply attracted the leather industry, which cut the trees for their bark only. The unwanted hemlock logs suggested to local businessmen that another industry could be introduced to make use of them, a plentiful and cheap source of wood fibers. The idea of a paper mill was born and it was a logical answer to the problem of how the unwanted wood could be put to a profitable use.

So it was in 1902 that the Munising Paper Co. was formed, a limited partnership. These were the partners: William G. Mather, president of the Cleveland Cliffs Iron Co., which had large land holdings in the area; H. H. Everard, a partner in a printing and stationery firm in Kalamazoo, Mich., and the first company president and mill manager; Charles D. Fuller, another Kalamazoo resident; J. T. and W. E. Upjohn, drug manufacturers in Kalamazoo; Charles H. Worcester, a Chicago lumberman; Lawrence Heyworth, a Chicago contractor, and Frank H. Milham, president of a Kalamazoo paper concern.

Work of the new company went ahead fast. They hired the J. N. Wallace Co. to design and build the mill, which was completed in the Fall of 1904 and began making paper on its two 120-in. machines at 4 p.m. on November 2 of that year.

(Incidentally, the story goes that the Munising machines are there almost by accident. They were built for shipment to Russia, and were completed, crated, and loaded on flatcars when some misfortune—probably the Russo-Japanese War—held up their shipment. While they sat on a railroad siding without a destination, the Munising Paper Co. buyers came along. And as a result, those machines are busily turning out products for American businessmen and American housewives instead of being somewhere behind the Iron Curtain.)

Products

The first product for which Munising's new mill found a market was unbleached wrapping paper–known then as butcher paper. For 10 years this was their only product; and then a new market opened up in the form of the "fine paper" line which has been an important product line to Munising ever since. So it was that in 1914 a Bellmer bleacher was installed and writing papers were first turned out as a Munising product. As these proved a valuable addition, another bleacher was added and both paper machines were put to work on writing paper grades. Since then, Munising's line of papers has included two or more grades of bond stock, as well as various ledger, mimeo, and duplicator igrades.

In recent years, the Munising line has added a couple of important new kinds of product—some well known to the householder and others less so. These are the household products, and the various treated papers—with literally dozens of industrial uses. The products grew out of the severe effect on Munising of the depression of the early 30's and the gradual swing to a line that includes besides the high-quality writing papers, a number of new developments for the paper industry.

It was in the early 40's, that in trying to find a product line more promising of profits without making it necessary to buy new machines and equipment, an absorbent paper, saturated with phenolic resin, was tried. Buyers of this paper were Formica, Richardson and Synthane—and they pointed the way to the new household line. Continuing research produced wet-strength "Silver Sheets"—a coated, treated paper for polishing silver, "Duo Dustin," treated dusting sheets, "Wax-Seel" self-sealing wax paper, and finally "Marvalon," a treated coated paper of great durability, printed attractively for use on tables, shelves, and counter displays.

Related to these household products is a more varied line of industrial papers, familiar to millions of users, but not identified by Munising's name. These are the products that use Munising paper, but in a converted form. There is the paper use of "Mystik" tape, tapes for binding the edges of lampshades, and the stock used for paper tape measures. Many home workshops have sandpaper using a Munising base sheet. Sand blast stencils, used by monument makers; colored paper used as decorative tapes and labels; book cover stocks; masking tape; gasket stock; stripping for the backs of tablets; sheets for separating rubber stock; floor covering; and many other uses that call for a material of great durability and flexibility, combined with economy.

K-C Enters the Picture

Doubtless it was this varied line of specialty products that first attracted Kimberly-Clark to consider the purchase of Munising, back in 1951. Our Research and Development people had been working on similar products, and the experience of Munising's scientists and operators fitted well into the pattern.

There were other factors too. One was that Munising's writing paper line of bond, ledger, mimeo, and duplicator grades, was well known in the field, and it was a chance to give K-C's sales force an additional line of products when they made the rounds of their customers. Another important reason was that the mill is located near the area in northern Michigan where the William Bonifas Lumber Co. carries on its woodlands operations, and the purchase gave us a chance to tie the entire woodlands procurement program together in a way impossible for separate companies to do.

But perhaps the most important reason, both to Kimberly-Clark and to Munising, was that the latter was experiencing financial difficulties, and it was plain to the owners of the business that some drastic measures were required. Perhaps a basic reason for the state of the mill and its future was a bonus plan that had gone into effect about 1940. It had been a money-maker for Munising's people and stockholders, but as often happens with long-term bonus plans, it resulted in neglected maintenance and development of the property. You can talk to any number of people in the mill and town who feel that another 3 to 5 years under the plan would have seen the mill closed down, no longer able to keep pace with its competitors.

This factor meant that the business was available at a price interesting to Kimberly-Clark, and the transaction was completed in December, 1951, giving the Munising Paper Co. a new lease on life and adding an important new line of products to the well-known Kimberly-Clark line-up.

It meant, too, that K-C's first efforts had to be directed toward building a sound financial base for the mill's future.

An important step, finally reached in October, 1953, after a period of study and work by Munising, Kimberly-Clark, and representatives of the AFL Papermakers and Pulp and Sulphite Unions, was discarding the bonus system. It was replaced with a new system of hourly rates (supplemented in a few operations by a piece-rate system).

This step maintained the good level of pay and still allows the company a brighter and healthier long-range picture. In fact, some things needed doing immediately, and these have been going on almost from the beginning of K-C's ownership. At the time of the purchase, the company announced that it would plow back Munising earnings to get the mill into competitive condition. Since that announcement those earnings, plus a substantial sum of K-C money has been funneled into Munising. Both buildings and machines have benefited. On the exterior, the whole appearance of the building has been changed by the replacing of the old windows with glass block. In addition, a new water tank was erected, a new woodyard crane procured, and numerous smaller repair and reconditioning jobs done. On the inside, a third saturator has been installed, another one rebuilt, and the obsolete electrical equipment replaced. On the 1954 schedule is a shutdown of the no. 2 paper machine for an extensive rebuild job and replacement of the stock system.

The first 2 years of building for the future have required about a million dollars, and other projects are still ahead. Those dollars have made the difference of an attractive, neat exterior for the mill and yard, a much more satisfactory working condition for its operators.

Munising, the town, has had a big stake in the paper mill. Although the paper industry arrived later on the scene, it has displaced the lumber industry as the most important in the locality. With a payroll of some 550, it is by far the largest employer and poor health for the company had meant poor prospects for this town of some 4700 inhabitants.

The Mill

Kimberly-Clark's interest in Munising centers, naturally, around the mill and its people. Pulp for Munising is largely sulphite, which is produced in their own three-digester pulp mill from some 50,000 cords of wood annually, part purchased locally and part imported from Canada. (The September–October *Co-op* told about the first shipment of wood to Munising from our own North Star operations in Minnesota.) Capacity of the pulp mill is about 100 tons daily, and until recent weeks the pulp mill was supplying a part of Niagara's requirements during a digest rebuild there. No groundwood pulp is made or used—Munising being what is known in the trade as a "free sheet mill." Some kraft pulp is shipped in both from Kimberly-Clark mills and other American and foreign sources.

(There are still problems to be solved at the mill, and one of them revolves around the pulp mill. Market pulp conditions have made this an uncertain area, and a number of questions are still unanswered on what steps will be taken in this department. Whatever the final action is, however, it will be made with the long-range stability of Munising as the important consideration.)

The paper mill has two J. H. Horne & Sons paper machines, producing a sheet that trims about 120 in. Machine speeds are from 250 to 560 ft., depending on the grade, and are equipped with size presses and tub sizing equipment for use on writing paper grades. Beaters are of the conventional tub type, with two jordans for each paper machine.

Munising's finishing room is not like the others in K-C, design as it is to handle mainly $8^1/_2$ by 11-in. sheet sizes. It is set up with a rather larger proportion of hand operation than is seen in other K-C mills.

Unusual at Munising is the converting division, where the household and industrial products are processed. The mill has three "saturators," which are impregnating machines used to treat paper (generally kraft) with a latex compound. (Kimberly-Clark's field service crews have been busy on this equipment in recent weeks and have largely transformed this part of the department.) There is also a coater, used to apply the water-resistant surface coat on certain grades—i.e., Marvalon. A waxer is used in converting Wax-Seel wrapping paper, and a finishing room handles the packaging of these products for the customer.

The boiler house is a relatively new concrete structure with two coal-fired boilers, producing steam for the mill and for electric power needs. On the waterfront, adjacent to the mill is a coal dock used for unloading coal from lake freighters. (The mill uses some 50,000 tons a year.) The woodyard has enough capacity for more than a year's supply (50,000 cords) of pulpwood, and uses a small jackladder and a system of metal sluices for moving wood from the lake booms, where it is delivered by water, to the block piles. For moving wood into the woodroom, the Anna River, a small stream emptying into Lake Superior adjacent to the woodyard, is diverted in a narrow, fast moving channel through the woodyard and into the woodroom.

Munising's mill continues to operate under its own name. Its men and women are traditionally proud of its position in the town and in the industry, and they are continuing to hold up that tradition. Kimberly-Clarkers have joined them in small numbers, but have made available their skills and experience in a way that already has shown results.

And Munising people—in the mill or in the town—will be glad to welcome visitors. They're old hands at it.

NIBROC CHEMICALS

True, Brown Co. is recognized as a leader in the field of pulp and paper manufacture, but there's more to the Brown Co. success story than those two products although they are the company's biggest lines. "Diversification" is an important word at Brown Co. It means that we manufacture a variety of products—all made from wood. Variety of products means that we are making the best possible use of our raw material and, at the same time, it means greater security for those of us who work for the company.

Previous issues of the *Brown Bulletin* have featured stories of pulp, paper, Bermico pipe, and Onco. Why? These articles were published so that you, the reader, could develop a general understanding of what we make and how we make it.

This article, "The Chemical Story," is the fifth of a series of product stories published for the purpose of acquainting our employees and friends with another group of Brown Co. quality products.

Actually, the primary purpose of the chemical plant is to produce the chlorine and caustic soda used in the preparation of Brown Co. high quality pulps. But the process we use also provides us with additional products which are sold to outside firms and communities.

At the present time all the caustic soda and about 40% of the chlorine production is used for the manufacture of pulp paper in Berlin.

Chlorine gas and weak caustic are made by passing a current of electricity through a solution of common salt. The chlorine gas is liquefied and delivered in tank cars under pressure, and the weak caustic soda is concentrated by evaporation and likewise delivered in tank cars. The pulp mills also use large quantities of bleach liquor which is made by mixing the chlorine and caustic soda in large tanks with water. About 80 tons of salt are used per 24 hours to produce the chlorine and caustic soda made at the chemical plant.

Caustic chlorine cells first reached the commercial stage about 1893 and it was only about 5 years later that a plant was started by C. B. Barton in Berlin. The company was then known as the Burgess Sulphite Fibre Co. C. B. Barton is recognized as one of the pioneers in the successful development of our present process in the industry.

Since 1950, 100 modern cells have replaced approximately 600 of the cells originally installed in the plant. This was done with no reduction in the amount of chemicals produced. These new units operate, however, with a substantial reduction in floor space and electricity required.

Liquid chlorine, in addition to its use in the manufacture of pulp, paper, and textiles, is also sold by Brown Co. for water purification. Chloroform is used as a solvent in the manufacture of many modern drugs. Incidentally, Brown Co. is one of the three largest producers of chloroform in the United States. Soda bleach is used in textile plants, laundries and for water purification.

Rome Kraft

Construction of the new containerboard mill of the Rome Kraft Co. on the Coosa River, 10 miles west of Rome, Ga., is on schedule and is expected to be in operation about the middle of 1954.

Construction, under the direction of Paul T. Leonard, project manager, Maxon Construction Co., Inc., Dayton, Ohio, began in October, 1951. Over 375,000 cu. yd. of dirt were moved on the 400-acre tract and the first concrete was poured in July, 1952.

Aerial view of Rome Kraft Co. containerboard mill under construction on the Coosa River, west of Rome, Ga. The machine room, machine shop, stores, and truck loading dock are in the center foreground. The group of buildings in the center background include turbine room, steam power plant, recovery plant, and digester building. The woodyard is in left background. The office building, not shown in the picture, is directly opposite the railroad loading dock at the right

Over 700 craftsmen are now at work on the mill which covers 160 acres. The main building is 666 ft. in length. Sections of the pulp mill are 110 ft. high. The smoke stack towers 250 ft. above the ground. The water treatment plant has a processing capacity of 20 million gallons per day. Transportation facilities are provided by the Central of Georgia Railroad, the Southern Railway System, and Georgia State Highway Route 20.

The mill when completed will be capable of maintaining a sustained annual rate of production in excess of 200,000 tons of kraft containerboard used in manufacturing corrugated shipping containers.

The mill represents an investment of over $25,000,000 and will provide employment for 650 men and women. Approximately 350,000 cords of pulpwood will be procured annually from Northwest Georgia and parts of Tennessee and Alabama, furnishing additional employment for 1200 people in the various woods operations.

Rome Kraft Co. is owned by the Mead Corp. of Dayton, Ohio, and the Inland Container Corp., of Indianapolis, Ind., owners of the Macon Kraft Co., at Macon, Ga. The officers of the Rome Kraft Co. are: Geo. H. Mead, chairman of the board; Al H. Mahrt, president; H. C. Krannert, vice-president; H. A. Kidd, vice-president and general manager; P. F. Holton, vice-president; G. B. Elliott, secretary and assistant treasurer; George Robinson, treasurer; Murray Smith, assistant secretary and counsel.

National Container

For National Container Corp.'s new 240-in. paper machine for the production of kraft boards and papers up to 2000 f.p.m. Valley Iron Works Co. provided both primary and secondary stock entrance equipment both of the full pressure totally enclosed type.

The primary is designed so that the wire at the breast roll is fed by direct pump pressure through a stainless steel flow manifold distributing the stock to the receiving box of the inlet. Here it is spread laterally across the full width of the machine and immediately passes through a series of rotating stainless steel distributing rolls of graduated design enclosed in curved conduit leading to a substantially larger distributing roll of special design and hence through the nozzle of the inlet to the paper machine wire.

The upper portion of the nozzle is not only adjustable as to angularity with the wire but is both vertically and adjustably moved up and down the wire while the machine is making paper and similarly with the lower portion of the nozzle or the apron.

All interior contours of the conduit are fully machined and lined with 1/8-in. thick stainless steel and all internal portions of the equipment are of stainless steel.

The secondary unit, which delivers stock to the wire at the suction boxes, is of related design and similar fundamental theory to the primary unit but necessarily arranged so that all components are above the wire. Similar flexibility and adjustability of the component parts are also provided herein.

The primary unit is of exactly the same type as started up last May on new no. 6 machine at Union Bag & Paper Corp., Savannah, Ga. The secondary unit is substantially identical with others operating for the past year and a half in several other kraft installations in the South and on the West Coast.

The multiwall bag division of National Container has announced a change of corporate name from the Jaite Co. to National Container Corp. of Ohio.

In addition to the original plant at Jaite, Ohio, National Container has recently acquired and now operates a fully equipped modern multiwall bag plant at Kansas City, Mo.

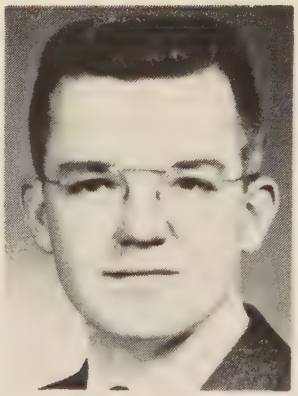
General sales offices for the multiwall bag division are located at the corporation's headquarters at 7 Central Park West, New York, N. Y.

La Monte

George V. La Monte, president, George La Monte & Sons, announced the following changes in personnel effect at a meeting of the Board of Directors held recently. John P. Feagley, N. Y. district sales manager of Youngstown Sheet & Tube Co., was elected a director, filling the post recently vacated by the death of Albert E. Howe. The following changes were made in the officers: M. L. Haggerty, vice-president to executive vice-president; Frank Church, comptroller to treasurer; David Nichols from secretary to vice-president and secretary; George V. La Monte, Jr., assistant vice-president to vice-president, and Wilbur D. Clare to vice-president.

Martin Luther Haggerty, executive vice-president and director of La Monte, was honored recently at a celebration of his 50th anniversary with his company, founders of the safety paper industry. In presenting him with a golden anniversary award, George V. La Monte, president of the concern,

M. L. Haggerty, George La Monte & Sons



G. B. Creamer, Rayonier Inc.

Wood formerly lost in cutting logs into lumber now goes into making high quality chemical cellulose. Here waste chips from lumber operations are loaded into truck at the Blagen lumber mill for a quick run to one of the three Rayonier chemical cellulose mills in Washington. Giant-size copy on truck panel informs carping critics that wood, pulp, and chemical cellulose producers are working hard to devise new techniques to cut down waste in all wood operations

said, "Few men in this specialized and essential industry have made as significant contributions in pioneering and developing the use and acceptance of protective check paper used in the banking industry throughout the United States."

Today, this specialized protective paper has uses far beyond banking, for it is used for documents, tickets, labels, coupons, and is adaptable for any purpose requiring positive protection against alteration and fraud. The main La Monte plant supplies safety papers throughout the United States and to many foreign countries. Canada is supplied by a subsidiary plant in Toronto.

Rayonier

The building for Rayonier Incorporated's Southeast Area Office has been completed and the departments located there began operations Feb. 8, Joseph B. Talbird, assistant company comptroller, announced recently. Erected on Walnut Street between Whaley and Wayne Streets, the new building was built coincidental to the construction of Rayonier's newest and fifth chemical cellulose plant, also located here. The Southeast Area Office houses the purchasing, industrial relations, and area comptroller's departments for Rayonier operations in Georgia and Florida, Mr. Talbird said.

Company officials said that the big, $25,000,000 chemical cellulose plant looked as though it would be ready to begin operations either in late March or early April.

George B. Creamer has been named manager of technical

Dinner in honor of M. L. Haggerty on the occasion of his 50th anniversary with George La Monte & Son

services for Rayonier, according to an announcement by Russell M. Pickens, vice-president in charge of sales. He replaces Maurice E. Kinsey, who has resigned to take a position with another company.

In his new position Mr. Creamer is primarily responsible for supplying assistance to cellulose users in the application of Rayonier pulps to their needs. He will report to the manager of sales, Michael A. Brown. Prior to his advancement, Dr. Creamer was a research supervisor at the company's Research Division at Shelton, Wash.

A new source of wood for Rayonier's Grays Harbor Division chemical cellulose mill has been developed by the Blagen Mill, lumber producers. Wood formerly lost in cutting logs into lumber could only be converted into "hog fuel." Now with new chipping and debarking plants, this wood is being converted into chips suitable for chemical cellulose production.

Chips from this mill alone will in the future greatly increase the amount of wood available for chemical cellulose, according to G. M. Rhebeck, Rayonier Northwest Timber Division manager.

Rayonier has had to install special equipment to handle the large quantities of chips required to make the operation economical. A special large, semitruck, which can haul 2000 cu. ft. of chips, has been acquired and a large hoist installed for dumping the 10-unit truck at the Rayonier plant.

The new operation, part of a continuing Rayonier program to put all of the wood to work, should help allay the occasional criticism that chemical cellulose and lumber producing operations contribute to waste. The new program is receiving wide local publicity throughout the Olympic Peninsula area where Rayonier maintains three large capacity mills.

Weyerhaeuser

A superior line of versatile hardboards, manufactured by a newly developed, flexible process, went into full-scale production in January in Weyerhaeuser Timber Co.'s Klamath Falls, Ore., branch plant. These hardboards are the first to be made by the dry process from defibrator whole-wood fibers.

C. C. Heritage, Weyerhaeuser's director of development, and Hugh B. Campbell, the company's Klamath Falls branch manager, describe these new hardboards as entirely different in raw material, performance, and characteristics from anything previously known in the forest products field.

"Instead of limiting production to a single line of hardboard products," Heritage said, "these new facilities were designed so that we can manufacture a line of custom-tailored boards to meet the exacting needs of various industrial users and processors."

Campbell reported that the basic raw material for the hardboards is white fir (*Abies concolor*) which occurs abundantly on the company's western pine area tree farms in Oregon. Research and development have shown white fir fiber to be superior to other species for hardboard processing.

In manufacturing hardboard, Weyerhaeuser literally takes a tree apart, processes the ultimate whole-wood fibers, and reconstitutes them into a new form of wood which then has a host of added qualities. Asplund defibrators reduce the white fir chips into fiber, unchanged from its natural condition in the tree, by rubbing the chips apart under an atmosphere of moderate steam pressure. Additives can be introduced for tailored uses during the defibrating process.

After defibration, the fiber is continuously felted from air suspension, then hot-pressed into boards, humidified to prevent warpage, trimmed, and cut to specified size.

Three types of hardboard are being made at Klamath Falls: standard, treated, and tailored-to-the-use. The latter category is in a class by itself. It can be designed to take various stresses and pressed to different densities and surfaces for bending, die-cutting, or for various finishes, depending upon specific customer requirements.

Both the standard and treated Weyerhaeuser hardboards score highly in their basic characteristics. In appearance, they have an attractive color (light tan), smoothness, surface texture (fiber fineness), and gloss; the surface is hard, the edges clean-cut and rugged. They have unusual durability—stiffness and transverse strength, impact and abrasion resistance.

The boards are easily handled, transported, applied, and finished by choosing from a range of surface dimensions, thicknesses, and densities. In regard to permanence, the boards have the ability to withstand, without undue change, exposure to moisture, heat, sunlight, air, microorganisms, vermin and rodents; they are dimensionally stable.

These boards are exceedingly workable, having the ability to be die cut, polished by buffing, easily and cleanly drilled, punched without burring, bent to permanent contours, sawed, flexed, sanded, painted without bleed-through, and to take all types of finishes.

In the more important characteristics, the boards have good uniformity, especially in color, thickness, density, and smoothness. The treated board, by choice of raw materials and processing conditions, including pressing to higher densities, provides a board of superior characteristics and performance.

Weyerhaeuser hardboards may be smooth on one side and a screened impression on the other, or smooth on both sides. These hardboards have great internal-bond strength which permits short-radius bends and close edge-nailing without breakout damage, and provide good gluing characteristics either to hardboard itself or to other materials.

Generally, Weyerhaeuser hardboards will go to four classes of customers: retail lumber dealers, distributors, industrial firms who will use it in their products, and to fabricators who will cut, shape, and process the board for industry.

The end uses for hardboards are practically limitless, in that new uses constantly are being developed. However, some of the current items in which hardboard appears are television cabinets and backs, auto parts, floor underlayment, mirror backs, furniture panels, drawer bottoms, sliding cabinet doors, display racks, core materials for veneers and metals and plastics, perforated board, plywood-and-hardboard combinations called "Plyron," die-cut boards, template boards, interior dry-wall panels, tiling, millwork items, toys, novelties, containers, window valances, home radiator covers, window seats, card table tops, bed headboards, wastebaskets, door panels, and many others.

The regular types of Weyerhaeuser hardboard are being made in four thicknesses: $^1/_{10}$, $^1/_8$, $^3/_{16}$, and $^1/_4$ in. The board intended for floor underlayment will be $^7/_{32}$ in. thick. Tailored boards can be made in varying thicknesses, densities, and types. Panel sizes for all types and thicknesses will be 4 ft. wide and up to 16 ft. long.

I.P.

An expansion of plant facilities of the Arizona Chemical Co. has been voted by the directors, Richard E. Sumner, president, has announced. The company, a jointly owned subsidiary of American Cyanamid Co. and International Paper Co., is a major producer of crude and distilled tall oil and tall oil fatty acids and is the sole producer of tall oil rosins.

Tall oil products are widely used by paint and varnish producers, and the soap, surface coating chemical and paper industries. Additional markets for tall oil products include linoleum and floor coverings, printing inks, metallic driers, detergents, disinfectants, lubricants and greases, and rubber. Among important crude tall oil uses are flotation, core oils, and asphalt additives.

The plant expansion will increase separating and refining facilities of the company's Panama City (Fla.) plant by two and one-half times. A substantial part of this increase will be in tall oil fatty acids and tall oil rosins. This is the only tall oil rosin admitted under the Naval Stores Act. Thus,

the expansion of facilities is expected to assure present and potential industrial users larger supplies at stable prices.

OLIN

Hearn Department Store, Inc. and Olin Cellophane have announced jointly that Hearn's has started wrapping merchandise throughout its entire store where practicable in cellophane packages made and sealed on the premises.

Hearn's Department Store, (New York) the nation's most complete self-selection department store, is converting its selling areas where feasible to cellophane packaging, with bags made and sealed on the premises following a technique worked out by Olin cellophane. Here, watching Mrs. Ilga Martin, assistant to the president, demonstrate in the dress shirt department the store's unique mobile bag-sealer, are Clement V. Conole, left, president of Hearn's, and Charles Pfeifer, New York and New England sales manager for Olin Cellophane

Edythe Gertler, buyer for the infants' wear departm at Hearn's, (New York) department store which has cently changed over to self-selection merchandising, amines a box displaying a baby dress wrapped in ce phane to protect it from soilage. The layettes behind are put up by Hearn's through a store-level pre-packag technique developed by Olin Cellophane

Executives of Hearn's find after several months of test that cellophane packaging increases sales and sharply reduces many merchandising costs, and solves many problems inherent in self-selection selling. Clement V. Conole, president of Hearn's, and Charles Pfeifer, New York-New England sales manager for Olin Cellophane, said the Olin Cellophane packaging program has proved so successful that by the end of 1954 it will be in force throughout all departments.

GAIR

George E. Dyke, president of Robert Gair Co., Inc., has announced the acquisition of Angelus Paper Box Co. of Los Angeles, Calif. Mr. Dyke stated that the purchase price was $3,618,000, of which $2,227,500 was paid in cash and the balance by the issue of 72,000 shares of Gair's common stock. It is planned to operate the business as the Angelus Paper Box Co. division of Robert Gair Co., Inc.

Angelus Paper Box Co., founded in 1912, operates two plants in Los Angeles. The main plant at 6001 S. Eastern Ave., completed in 1947, comprises a modern paperboard mill, producing various types and grades of paperboard, with which are integrated folding carton and corrugated shipping container operations. A smaller plant on 61st St., near Avalon Blvd., manufactures setup boxes. William T. May, Jr., vice-president in charge of container operations, Robert Gair Co., announced the appointment effective January 1 of Floyd C. Costello as assistant general production manager for container division operations.

Mr. Costello was formerly manager of Gair's Teterboro (N. J.) Container Division. He joined a predecessor company, Piermont (N. Y.) Paper Co., in 1913 as a stenographer. Ultimately he became division manager there and left that plant in 1933 for a similar position at Gair Bogota (N. Corp. when that plant was acquired. Mr. Costello t: ferred to the new Teterboro building in February, 1952, w Bogota operations were moved there. He is a nati Poughkeepsie, N. Y.

"PAPYRUS"

Two hundred and fifty years ago a young Jesuit, Fa Jean Imberdis, was inspired by the three hundred paper r then working in the neighborhood of his birthplace, Am in the Auvergne, to write *Papyrus*, a Latin poem on pa making, in imitation of Virgil's famous poem on agricult the *Georgics*. In nearly five hundred hexameters Imbe gives a unique and picturesque account of the craft as it then practiced. It has always been a rare book, and now Paper Publications Society of Hilversum in Holland printed an exquisite edition for its members, with a graceful and efficient first translation into English by Profe Eric Laughton of Sheffield University. By kind permis of the Society and Professor Laughton an account of the b can be freely illustrated with quotations.

The poet begins, as he should, with the choice of a site the mill; the climate must be neither cold nor hot:

> For icy Winter freezes up the Burn,
> And torrid Summer parches it in turn.
> The Master—he to whom his Craft is dear—
> Must look on both extremes with equal fear.

That settled, water is the paramount consideration. D ent streams suit different trades but:

> If Paper be the object of your Quest,
> That stream, and that alone, is best,
> In whose clear, crystal Depths one may descry

And count the very Pebbles where they lie;
Wherein full many richly speckled Trout
In serried Shoals do sport and leap about.

The trout are evidence that the water is pure, but it appears later that they have another value:

If a new Hand you hire, upon that day
Look not for any Paper; all is Play.
Then all delight to foot it in the Dance
On river bank or meadow's smooth expanse;
Then with the baited Hook to lure the Fish,
Then to feast merrily with sumptuous dish.
The Stranger pays for all; should he deny,
The others would abjure his Company.
All this you shall with wise forbearance see;
'Twere useless to prohibit; let them be.

Even the best streams, however, are liable to be muddied by excessive rain; a wise Master will have stored some clear water in his vats, but sometimes it will not be enough:

Once, I recall, when rainy Spring was nigh,
For twenty days from bursting Clouds on high
A mightly Flood hissed down; in every place
The swollen Streams did thick and turbid race.
Then to and fro the Paper-maker went,
Moaning his cruel lot with loud Lament.
The gifts of Bacchus cannot give him ease;
In this Distress no festive Pastimes please
With wonted Exercise; he weeps full sore,
And with his Tears augments the Flood yet more.

Having found the right stream, the Master will select a steep reach of it where the water falls "pellmell adown its sloping Race," and there he will erect his water-wheel. To the wheel he will attach a large shaft, studded with wooden pegs which, as the shaft revolves, lift a row of stamps which pound into mortars beneath them:

Three oaken Stamps let every Mortar take,
The which you shall be well advised to make
With countless Nails all horrid underneath,
Their jagged shape resembling rows of Teeth.

The rags, already rotted by frequent dampings (the Hollander was not yet invented), and cut into small equal pieces, were already soaking in the mortars:

so, without delay,
The wooden Stamps forthwith begin their Play.
Rising and falling in a rhythmic Row,
They beat with pond'rous stroke the Cloth below,
Till, as they rend and pound, and pound and rend,
The stuff is shredded finely in the end.
The Neighbourhood re-echos with the Shock;
The very Mill's foundations shake and rock.
The hills reverberate, and all the ground
Quivers and trembles with the awful Sound.
E'en so the massive Stamps at headlong rate
Pound up the Rags, nor do the blows abate
Until the Fabric into milky Froth
Melts and dissolves, like unto tepid Broth.
Yet 'tis not ripe for Paper even now.
More Stamps there are, the which with blunter Row
Of Nails are armed; to these the Cloth submit,
That ever finer they may batter it,
Nor take it out till two full hours are past,
Unless they folly would the Labour waste.

For good paper only fine white rags will do, but these will be supplied abundantly by the rag merchant:

Pursuing often, poor and meanly clad,
Through towns and villages his roving Trade;
And street and corner, as he passes by,
Re-echo with the old, familiar cry:
"Old rags to buy! Bring out your rags and sell!
Here's pins and needles to repay you well."

From the mortars the pulp is poured into a "vasty cauldron" (the vat) warmed from beneath by a gentle fire, and there it is stirred frequently with a paddle while the vatman exercises his art:

So, if to fashion Paper is your aim,
Take up, I pray you, a four-cornered Frame
Of copper-mesh, from Bend and Roughness free,
That over all the Surface there may be
An equal Tension; then, if smooth and true,
'Twill give a Smoothness to the Paper too.
Now do the Hands, by long experience deft,
Holding the Mould between them, right and left,
Dip it to catch the liquid Pulp below;
Then with a swaying motion, to and fro,
So rightly do they mingle all thereby,
The Stuff in even thickness straight will lie.
All that is needful settles there to stay;
The Superfluity will drain away;
At once you see the longed-for Sheet appear,
Ere that your eyes can note the Process clear.
Yet not at all times is the Work the same,
Nor one way only should you move the Frame;
One motion for a slender Page is meet,
Another, if you need a stouter Sheet.

At this point the poet turns aside to sing the misery of men when they had only beech or poplar leaves on which to write their love-songs and their letters, and how the invention of papyrus, though it made even books possible, had but a wrinkled and dusky surface compared with smooth white paper. Then he resumes his theme, and tells how from the mould each sheet is "couched" upon a felt, and a "post" of alternate sheets and felts is pressed:

Let lusty youths exert their sinews stout
The creaking Screw to turn and turn about.
Not in such quantity does Sponge emit
The moisture that has been soaked up in it;
Not flows the Juice from trampled Grapes so free
As liquid from the Paper pressed shall be.
And that which stood a lofty Heap before,
Now lowly lies; yet is its strength the more;
Close-textured now, the touch of Hand 'twill bear
Resilient; no cause henceforth for fear.

After two pressings the sheets, still damp, are taken to the drying shed, and there, "stretched in rows on many a Rail, close to the Roof," exposed to the draught from many open

The art of papermaking

windows, except when the wind is too cold and damp. Open windows, however, let in a ruthless enemy, "the greedy Tit," whom neither scare-crows, nor bird-lime, nor traps can deter:

Small is this naughty Fowl, yet it can wreak
No small Destruction with its claws and beak.
For, when the Paper from afar it spies,
Straightway through open Window in it flies.
Its frequent blows the Sheet do quickly tear
Still sodden, and make Havoc everywhere.

Next, when the sheets are dry, they must be dipped in size, "a sticky juice" exuded by the ears of sheep and oxen when boiled in water, and after more stacking and pressing to smooth out creases, they are ready for the market, and the poet's task is ended. If, however, the reader's desire for knowledge is still unsated, he is recommended to go to Ambert:

Three hundred Paper-mills this place around
Make all the Region echo with their sound.
Nowhere through Pastures green do Streams more clear,
In number more abundant, flow than here;
Nowhere a whiter Paper shall you find,
Nor one for Books more perfectly design'd.

—Reprinted from *The Paper-Maker and British Paper Trade Journal*, January, 1954.

Pacific Q.C.

Methods of producing products or services of guaranteed quality will be discussed at the Second Pacific Northwest Conference on Quality Control April 2 and 3 at the University of Washington, Seattle. Programs and registration forms may be obtained from Norman W. Steele, Jr., 701 N. 100th St., Seattle, Wash.

On April 2 the conference will offer training sessions on basic and advanced quality control techniques. Featured papers will be presented on April 3 by Prof. Eugene L. Grant, Stanford University, Dale Lobsinger, United Airlines, Denver, and Eugene Goddess, Boeing Airplane Co., Seattle. In addition, H. T. Broderson, Johns-Manville Co., Pittsburg, Calif., will show his company's film "Modern Quality Control."

The conference is sponsored by the Seattle Section of the American Society for Quality Control in cooperation with the Colleges of Engineering and Business Administration of the University of Washington.

Western Michigan

The Port Huron Sulphite and Paper Co., Port Huron, Mich. has just presented to the paper technology department at Western Michigan College a new digester.

The stainless steel digester is a laboratory size and was produced by the Michigan Steel Castings Co., Detroit.

This latest device will be installed in the paper laboratories at Western Michigan College, according to A. H. Nadelman, head of the paper technology department. On receipt in Kalamazoo it weighed more than 800 lb.

After more than 5 years as the paper technology curriculum, a function of the chemistry department, the paper studies at Western Michigan College have been given full departmental status.

This step marks another period of growth for the paper technology studies here, according to A. H. Nadelman, who was promoted at the same time to department head.

British Industries Fair

The British Industries Fair, Britain's annual show window of new trade products, will be held this year in London and Birmingham from May 3 to 14.

Two thousand exhibitors representing nearly 100 different industries will demonstrate to home and overseas buyers a cross section of British production from confectionery to concrete mixers. Consumer goods will be shown at two halls in London—Olympia and Earls Court—while heavy indu will appear at the giant exhibition hall at Castle Brom Birmingham.

The heavy industry section will again cover the gre area. Among consumer goods, the Boat and Small Section, an innovation in 1953, will more than double year's size. Gifts and decorative accessories will oc its biggest space since 1948. Musical instruments will the greatest display of pianos since the war; Scientific optical instruments will have a large section, as will p and stationery.

The future of the B.I.F. as an annual event has bee sured by the recommendations of a recent Committee o quiry, and plans are under way for welcoming the thous of overseas buyers who are expected to attend in (Last year 996 United States buyers attended.) Adv catalogs with exhibitors' names, addresses, and proc will be available to United States businessmen in adv of the Fair. Prospective visitors are invited to ask the est British Consulate for a free copy, indicating whether need the London or Birmingham edition, or both.

Graphic Arts Meeting

Papers on technical problems in the graphic arts are being assembled and reviewed by the Technical Associati the Graphic Arts for its sixth annual meeting on May 10 11, 1954. To be held in the Schroeder Hotel, Milwau the 2 days of technical sessions will be devoted entirel technological problems faced by the printing indu Covering a wide range of interests in the graphic arts, T will present a program covering both private and cooper research on printing problems. TAGA now has membe Denmark, Sweden, Holland, England, Australia, and Ca

Further details concerning the meeting can be obt from Richard Shaffer, Pratt Institute, Brooklyn, N president of TAGA, or from George Hammer, Forbes L graph Manufacturing Co., Boston, Mass., its secre treasurer.

Low Temperature Packaging

Polyethylene may become the first billion-pound- plastic, according to a prediction by A. J. Freeman of Ge Mills Research Laboratories. Mr. Freeman spoke at symposium on low-temperature test methods and stand for containers, sponsored by the National Academy of Sci through the National Research Council's Advisory Boar Quartermaster Research and Development, and held in cago last December. Polyethylenes in general have recognized as having excellent low-temperature toughness low-moisture absorption, Mr. Freeman stated. Impo properties of polyethylene resin for film use include mole weight. Films with the highest molecular weight were to have the lowest cold brittleness temperature and the tear and puncture resistance.

Many other packaging problems caused by exposu subzero temperatures were discussed at the Palmer H symposium. Berton S. Clark, American Can Co., who sided over this meeting on Low-Temperature Test Met and Standards for Containers, called the symposium to and after a brief explanation of the purpose of the mee introduced W. D. Jackson, chief, Research and Develop Division, Office of the Quartermaster General, who gave address of welcome. He was followed by Donald K. Tres scientific director, Quartermaster Food and Containe stitute, who emphasized the importance of low tempera performance in military packaging.

Earl C. Myers, associate director, QM Food and Cont institute, was chairman of the first technical session. Incl in this part of the program was a report by P. W. Espensch Corps of Engineers, U. S. Army, presenting technical dat many of the low-temperature research installations in

United States being used by or available to the military for low-temperature research. Properties of wood and wooden containers at low temperatures were described by Kenneth Boller, Forest Products Laboratory, Madison, Wis. Wood is generally stronger at low temperatures, Mr. Boller stated—in fact, from one-and-one-quarter to three-and-a-half times as strong, depending upon the strength property involved. This finding conforms to the general law that as the temperature goes down the resistance to form changes of solid or liquid substances increases. In practical applications of wood and wood products many other factors such as moisture content, imperfections, and fastenings must be considered along with temperature. But the net result, in most cases, is that the product does not lose strength as a result of subnormal temperatures.

The testing of multiwall bags and other packages at low temperatures was discussed by R. T. Seith, Mosinee Paper Mills; L. E. Simerl of Olin Cellophane Division presented a paper on water vapor permeability of sheet materials; he revived the ASTM standards for tests and listed physical properties of various packaging films. Discussion leaders at the morning technical session included J. A. Miller, California Research Corp., F. E. Dickinson, University of Michigan, Charles J. Zusi, Container Laboratories, Inc., and Karl Kammermeyer, Iowa State University.

The second technical session was presided over by Howard M. Weiner, Picatinny Arsenal, who was also the author of a paper on low-temperature degradation of flexible barrier materials in which he described in detail the cycling tests used in connection with evaluation of packaging materials. He reviewed the various military specifications applicable to flexible barrier materials and the performance tests involved. L. F. Zsuffa, Georgia Institute of Technology, discussed the design and construction of the QM Climatic Research Chambers at Natick, Mass. These facilities will be used by the QMC for environmental research on many kinds of military supplies and on military personnel. Discussion leaders for the second technical session included David H. Rest, QM Food and Container Institute, Jules Pinsky, Plax Corp., and Leonard F. Sweo, H. P. Smith Paper Co.

At the closing session the status of other research work on performance of containers at low temperatures was discussed and the testing methods used were described. Also discussed were the need for and coordination of low-temperature packaging research and methods for accomplishing desirable interchange of information.

Rohland A. Isker, Research and Development Associates, Food and Container Institute, Inc., was the luncheon speaker. His topic was special needs of military packaging. Approximately 100 industrial and governmental engineers and scientists engaged in low-temperature work attended the symposium. The papers and a condensed account of the discussion will be published and made available to container specialists and others who have technical interests in the problems discussed.

Basic Materials Conference

The three-day Basic Materials Conference will be devoted this year to a comparison of the properties and characteristics of materials in relationship to each other, it was announced by Clapp & Poliak, Inc., New York, producers of the conference.

The conference will be held concurrently with the Basic Materials Exposition, the product development show, at the International Amphitheatre, Chicago, May 17–20.

"The purpose of the conference will be to acquaint executives with the relative advantages of using a particular material instead of another," said Saul Poliak, president. "We shall not attempt to conduct a session which explores all the properties of a particular material. That is being done by many meetings in vertical fields.

"However, a manufacturer who is undecided about the use of plastics, or wood, or steel, or rubber, or light metal for next year's model should find his answer either in the conference sessions or on the exhibit floor. The approach will be functional and comparative to permit the broadest possible base for a decision," Mr. Poliak said.

T. C. DuMond, editor, "Materials & Methods," will be general chairman of the conference. Serving with him, on an advisory committee, will be a group of 18 scientists, researchers and design engineers, drawn from the top levels of the country's industrial and governmental organizations.

Bureau of Standards

"Report of the Thirty-Eighth National Conference on Weights and Measures, 1953," National Bureau of Standards Miscellaneous Publication 209, 116 pages, is available at a cost of 40 cents from Government Printing Office, Washington 25. D. C.

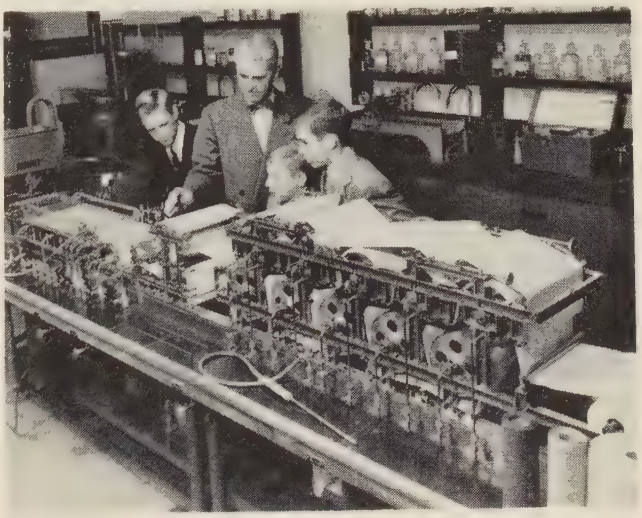
This publication contains the addresses and reports on weights and measures given by representatives who attended the conference sponsored by NBS May 19–22, 1953, and a list of all delegates including the conference's officers and committees. The report covers such topics as prepackaged foods, flour weights, automatic packaging machinery, livestock weighing supervision, electronic scales, technicalities in weights and measures court cases, the proposed international conference on legal metrology, and the performance of inspectors and gasoline pumps. The report also includes actions of the conference with regard to recommended methods of sale of anhydrous ammonia and other liquid chemical fertilizers with pressure characteristics; preheated fuel oils; peat moss in package form; rope; seeds (agricultural, horticultural, and floricultural); and pickles and pickel products in package form.

American Polymer

American Polymer Co., of the Chemical Division of the Borden Co., Peabody, Mass., announces a new freeze-thaw stable butadiene-styrene latex, designed as P-556, and described in the company's Data Sheet P-29 supplement.

Klein Directory

B. Klein & Co., 27 E. 22nd St., New York, N. Y., has published a new "Guide to American Directories for Compiling Mailing Lists," available from Klein at $10 per copy including 12 bi-monthly supplements.



The P & W miniature paper machine which was exhibited at the Commodore Hotel during the TAPPI convention. Photograph taken at Stamford Research Laboratories of the American Cyanamid Co. showing A. L. Peiker of Cyanamid and the three sons of C. S. Maxwell of the Laboratories

Albany Felts

On January 21 a group of trade paper editors serving the pulp and paper industry visited the plant of the Albany Felt Co. at Albany, N. Y., to be made acquainted with the

Top row, left to right: W. Fry, production manager; W. Sizer, ass't. vice-pres.; D. Brinker, Woodard & Voss; C. Clifford, treasurer; W. Davis, ass't. vice-pres.; A. Cramer, secretary; E. Reed, plant manager; S. Van Praag, ass't sales manager; G. Woolfe, sales dept.; Phil Voss, Woodard & Voss; J. Smith, ass't. sales manager; T. Woodard, Woodard & Voss. Front row, left to right: J. C. W. Evans, Paper Trade Journal; *L. R. Parker, exec. vice-pres., Albany Felt Co.; R. G. Macdonald,* Tappi; *C. Heffernan,* Albany Times Union; *J. Miller,* Southern Pulp & Paper Manufacturer; *B. Otis,* Paper Trade Journal; *Harry Weston, National Superintendents' Assoc.; D. Marvin,* Troy Record

operations and with the future plans of the company. A press conference was held at the Fort Orange Club in Albany on the evening of January 20 at which time the editors discussed

H. J. MacMillan, S. Engle, and H. Hedberg of the Albany Felt Co.

with the executives of the company, the company history, policy, and plans for the future. During the tour of the plant the editors were impressed with the unusually fine appearance of the buildings and surroundings as well as the excellent spirit among the employees. Any user of papermaking felts is well advised to stop over in Albany and visit the plar A courteous reception is assured and the tour through t plant will be impressive.

Albany Felt Co. of Canada Ltd., Cowansville, Que.

Deerfield Plastics

Deerfield Plastics Co., 271 Main St., South Deerfiel Mass., a newly formed corporation, has purchased the pla formerly used for the manufacture of fine leather goods b the Arms Mfg. Co. Principals of the new company a

E. R. Barker, K. T. Barker, and E. R. Barker, Jr., Deerfie Plastics Co.

Elliot R. Barker, president, Kenneth T. Barker, gener manager and treasurer, and Elliot R. Barker, Jr., productio manager and clerk of the corporation. The company w perform custom extrusion and fabrication of cellulose acetat butyrate, polyvinyl chloride, acrylics, and polystyrene.

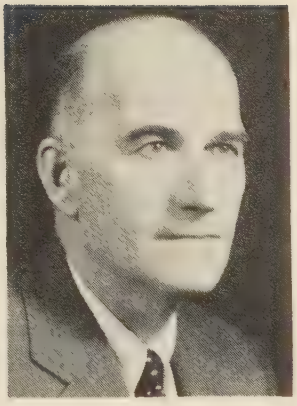
G.E.

General Electric Co., Schenectady, N. Y., has issued a bull tin (GEA-6061) giving selection information on motor starte and push-buttons.

Allied Chemical & Dye

The Nitrogen Division, Allied Chemical & Dye Corp 40 Rector St., New York, N. Y., has announced a new pocke size device for detecting ammonia leaks. Known as "Su stix," the new sulphur-impregnated tapers may be obtain free of charge from the company.

M. Nielsen, The Babcock & Wilcox Co.



W. D. Sullivan, The Babcock & Wilcox Co.

F. G. Merckel, Wallace & Tiernan Co., Inc.

R. M. Jackson, Wallace & Tiernan Co., Inc.

WESTINGHOUSE

Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa., has issued a technical data booklet (TD52-601) on current and potential transductor magnetic amplifiers. Also available is a bulletin describing a new all-electric heat pump, obtainable from Westinghouse Air Conditioning Division, Dept. T-557, 200 Readville St., Hyde Park, Boston 36, Mass.

Westinghouse has announced a new induction motor, the Life Line-A, designed for longer life, greater flexibility, and decreased size.

RUBBER AND ASBESTOS

A new "flying splice" adhesive of the pressure-sensitive type, "BondMaster 59" which is claimed to offer extremely high tack coupled with superior bond strength has been announced by Rubber and Asbestos Corp., Bloomfield, N. J.

B & W

M. Nielsen, vice-president of The Babcock & Wilcox Co., has been elected a member of the board of directors and placed in charge of the company's Boiler Division, according to an announcement by Alfred Iddles, president. The appointment fills a vacancy created by the death of J. H. King. W. D. Sullivan has been elected a vice-president of B & W and placed in charge of the manufacturing department of the company's Boiler Division.

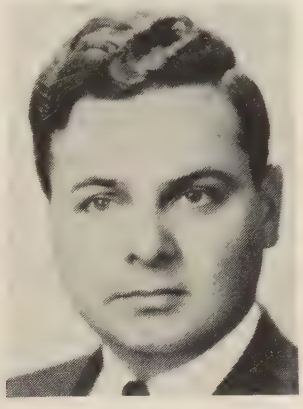
WALLACE & TIERNAN

Following the merger of Wallace & Tiernan Co., Inc. and Novadel-Agene Corp. to form Wallace & Tiernan, Inc., it was announced that F. G. Merckel has been elected president, R. M. Jackson, executive vice-president and treasurer, and G. D. Peet, vice-president in charge of product engineering and development. The announcement was made by M. F. Tiernan, chairman of the board. Responsible to Mr. Merckel in staff capacities will be: H. C. Marks, director of laboratory research; David Crampton, chief chemical engineer, J. C. Cornwell, secretary of the corporation; and T. T. Quigley, assistant to the president and operational analyst. It was also announced that Wm. J. Orchard, long-time general manager of Wallace & Tiernan and vice-president of Novadel, who reached his 65th birthday last month, will remain on the board of Wallace & Tiernan but will retire from active management.

ANHEUSER-BUSCH

Tate M. Robertson, Jr., sales manager of the Corn Products Dept. of Anheuser-Busch, Inc., St. Louis, Mo., has announced that Robert A. Lemieux, sales representative, is now working out of Dayton, Ohio, under the direction of Carl F. Hoelderle, Lake States regional manager.

G. D. Peet, Wallace & Tiernan Co., Inc.



R. A. Lemieux, Anheuser-Busch, Inc.

Interesting to the paper mill industry is this typical informal scene at the recent developmental week arranged by Buckman Laboratories, Inc., at Memphis, Tenn. At such conferences as these in the Buckman Library microbiologists, chemists, and technical service representatives reviewed successful treatment methods, new technics and new products in the field of microorganism control. Those in the photograph are from left to right: R. C. Quick, Eastern Chemicals, Inc., Albany, N. Y.; J. D. Pera; T. E. Pattison, Buckman Laboratories of Canada, Ltd., Montreal, P. Q.; Leslie Newcomb; J. M. Sharpley; E. F. Weiss; J. W. Appling; W. D. Stitt; L. B. Greiner, Benlo Chemicals, Milwaukee, Wis.; S. J. Buckman; Armando Ulled, C.O.S.A.R.I., Buenos Aires, Argentina; H. T. Gardner, Pacific Coast Supply Co., Portland, Ore.; B. A. Taylor, James A. Taylor & Son, Kearsarge, N. H.; H. R. Davidson, Buckman Laboratories of Canada, Ltd., Toronto, Ont.; C. P. Kirchen; and Charles Bassemir, O. L. West, Philadelphia, Pa.

SANDOZ

James C. Walker, vice-president in charge of the Dyestuff Division of Sandoz Chemical Works, Inc., announces the appointment of Raymond J. Mitchell as manager of Sandoz's Cincinnati branch.

DOWNINGTOWN

The Downingtown Manufacturing Co., Downingtown, Pa., has announced the following changes in the sales and engineering departments: appointed executive vice-president is Harry C. Merritt. Appointed chief engineer is Jack C. Harper. Richard W. Polleys and Jacob V. Edge have been appointed assistant sales managers. F. L. Wooten is now sales representative; C. H. Mullen and Joseph W. Martin sales engineers.

REICHHOLD

The Watson-Park Co., Ballardvale, Mass., has merged with Reichhold Chemicals, Inc., according to an announcement by Henry H. Reichhold, chairman of the board.

MONSANTO

Monsanto Chemical Co., Organic Chemicals Division, 1700 S. 2nd St., St. Louis, Mo., has issued a bulletin (No. 0-102) giving typical reactions of fumaric acid and properties of its products.

CONTAINER LABS.

Charles J. Zusi, president of Container Laboratories, has announced the appointment of James A. Sargeant as manager of the company's Chicago laboratory.

PARSONS AND WHITTEMORE

W. J. Zimmerman, former chief engineer of both the Mead Corp. and Abitibi Power and Paper Co., has been appointed senior engineer of the pulp and paper project division of Parsons and Whittemore, Inc.

DRAPER

The directors of Draper Bros. Co., Canton, Mass., have named John H. Draper as president following the resignation of Copeland M. Draper, and the discontinuance of its line of knitted outerwear fabrics.

DORR

T. Bartow Ford, vice-president in charge of sales, the Dorr Co., Stamford, Conn., has announced the appointment of William E. Smith as assistant sales manager, Glen O. Wilson as manager of North American industrial sales, and William T. Marston as manager of the western industrial division.

CARBORUNDUM

W. J. Ulrich, senior sales representative of the Carborundum Co. in the Detroit area, has been elected vice-president of the company.

WITCO

Witco Chemical Co., 260 Madison Ave., New York, N. Y., has issued a bulletin (S-8) announcing a new lead compound, Stayrite no. 229, for stabilizing halogen-containing organic materials.

INGERSOLL-RAND

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., has published a bulletin (Form 9041) describing its line of floor-mounted, direct-contact barometric condensers.

RELIANCE

E. E. Helm, vice-president of sales of the Reliance Electric and Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio, has announced the addition of six application engineers to its sales offices as follows: A. W. Bridges and L. W. Kut Philadelphia office, C. A. Emmert, Baltimore office, James V Landers, Newark office, William M. Morris, Jr., New Hav office, and William J. Constandse, Cincinnati office.

A-C

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has issued bulletin (05E8008) giving standard construction features A-C engine-type, low-speed synchronous motors.

WIEGAND

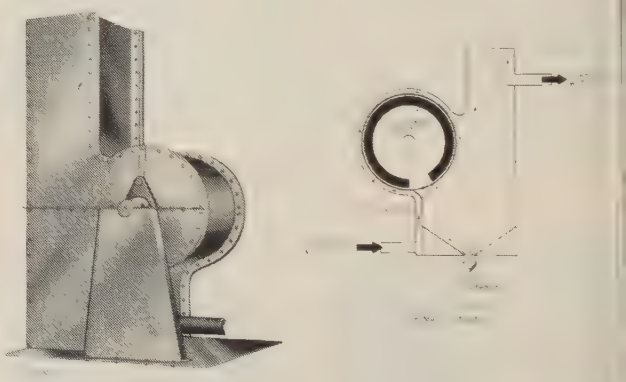
Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburg Pa., has issued a bulletin (Folder C3-606) describing a ne heavy-duty infrared generator for high-intensity heating r

Chromalox radiant heating panel

quirements. Designed for web-fed processes in the pape textiles, and plastics industries, the generator is known as t Chromalox Electric Radiant Heating Panel.

BLACK-CLAWSON AND SHARTLE

The Black-Clawson Co., Hamilton, Ohio, has announced new clarifier system for paper and board mill waste. Usi magnetic clarifiers, the new system is claimed to be capab



Pilot model and schematic diagram of Black-Clawson magnetic clarifier

of clarifying water over 1000 times faster than any othe known existing system.

Shartle Bros. Machine Division, Middletown, Ohio, ha issued a bulletin (16-58) describing the new Hydrabeater.

EASTWOOD-NEALLEY

Eastwood-Nealley Corp., Belleville, N. J., has published

booklet, "Fourdrinier Wires and the Human Factor," illustrating the various steps in the manufacture of paper machine wires.

FMC Chemical

Alfred T. Loeffler has been appointed vice-president of the Chemical Divisions of Food Machinery and Chemical Corp., 161 E. 42nd St., New York, N. Y., according to an announcement by Ernest Hart, executive vice-president of the corporation.

Sveen-Pedersen

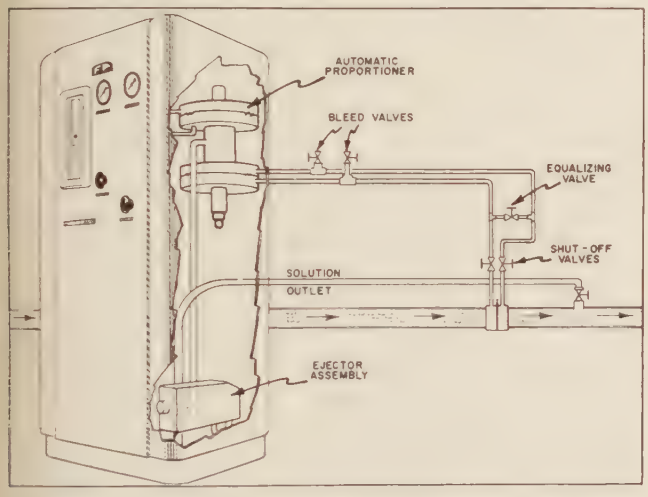
Sveen-Pedersen Sales Corp., 25-36 Jackson Ave., Long Island City, N. Y., has announced the appointment of Fritz Meyer as president, and O. F. Hutchison as director of sales.

American Resinous Chemicals

American Resinous Chemicals Corp., Peabody, Mass., has announced the development of ARCCO C602, a polyethylene overprint varnish for the protection of inked surfaces.

F & P

Fischer & Porter Co., Hatboro, Pa., has announced the development of a new corrosion-resistant automatic proportioning component for chlorinators, designed to feed chlorine



New Fischer & Porter automatic proportioner for chlorinators

to water or sewage lines in a direct and preset proportion to the flow rate, however, it may vary.

F & P has also issued a new catalog (no. 2) describing process and control instruments available for immediate shipment from stock.

Staley

G. H. Batchelder has taken over new duties in the Boston office of the A. E. Staley Mfg. Co., Decatur, Ill., and is succeeded as Boston manager by R. E. Kilty.

Raybestos-Manhattan

Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J., has issued a bulletin (no. 6628) describing new R-M Super-Power V-Belts.

J. H. Matthews, R-M executive vice-president, has announced the appointment of C. P. Hugh as assistant director of research and product design, S. F. Horesta as manager of the roll and tank departments, and E. D. Hines as assistant manager.

Nopco

Nopco Chemical Co., Harrison, N. J., has announced the appointment of Irene Dennery as advertising and sales promotion manager.

Irene Dennery, Nopco Chemical Co.

Hooker

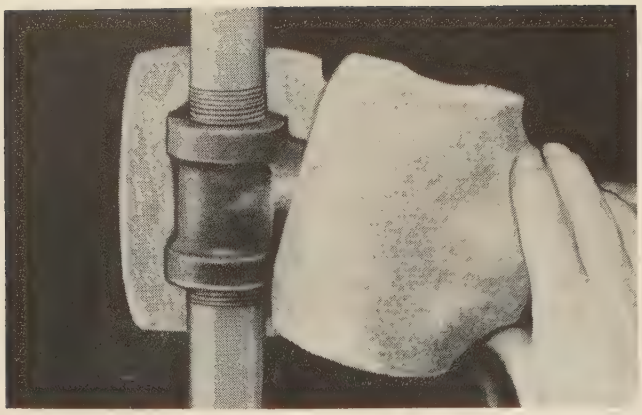
Hooker Electrochemical Co. has been certified as "excellently managed" by the American Institute of Management for the fourth consecutive year, it has been announced. Jackson Martindell, president of the Institute, said that Hooker was rated in the top half of the 348 companies in the United States and Canada which were found eligible to receive the designation for the year 1953, out of 3000 leading concerns whose methods were evaluated.

Fiberglas

Owens-Corning Fiberglas Corp., Toledo, Ohio, is cooperating with the Massachusetts Institute of Technology in fostering general and acoustical research.

Fiberglas acoustical tile emerges from the final paint drying operation and again is inspected and imperfect squares removed. Tile to be perforated is moved to another position on the fully automatic production line

Fiberglas has completed the first phase of its $500,000 program of expansion and improvement of its accoustical tile manufacturing facilities at Newark, Ohio.



Manufactured in accurately preformed halves, Fiberglas molded pipe-fitting insulation is light in weight, easy to apply, provides an attractive appearance and has long life. The two halves may be stapled, wired or taped together for permanent or removable attachment

Newest product of the Fiberglas industrial line is molded pipe-fitting insulation, manufactured in preformed halves.

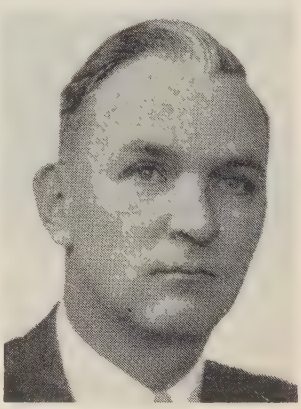
GURLEY

W. & L. E. Gurley, Troy, N. Y., have announced a new Permeometer for measuring the porosity or air permeability

New model Gurley Permeometer measures very porous papers

of materials too porous to be tested accurately or conveniently with the Gurley densometer.

A. C. Seaton, Farrel-Birmingham Co., Inc.



P. H. Thomlinson, Farrel-Birmingham Co., Inc.

FARREL-BIRMINGHAM

After completing more than 50 years of company servi Albert C. Seaton, Farrel-Birmingham's manager of roll sa retired Dec. 31, 1953. He was succeeded, as of the first of t year, by Percy H. Tomlinson who, for several years, was assistant.

OBITUARIES

Harold Willson Rogers

Harold Willson Rogers, of 1142 Rugby Rd., Schenectac N. Y., a retired General Electric Co. Engineer, died on Jar ary 21 at Ellis Hospital after a short illness.

Mr. Rogers retired as Engineering Consultant, Paper a Textile Division of General Electric on May 1, 1948, after years of service.

Born in Hartford, Conn., April 28, 1883, Mr. Rogers v graduated from Worcester Polytechnic Institute in 1906 w a Bachelor of Science Degree in electrical engineering. joined the General Electric Test Course the same year. was transferred to the Power and Mining Department, n the Industrial Engineering Section, in 1907 and had been gaged in industrial application engineering from that time

In 1908 he was assigned to study the electrification of ste power shovels and his pioneering work at that time est lished the pattern for the system now universally used on important excavating machinery. Subsequently he und took the development of the sectionalized paper mach drive, and as part of this program tested and analyzed pa making machinery so completely and thoroughly that power constants are recognized as standard for the indust

In 1922, Mr. Rogers was placed in charge of the Industr Manufacturers Section of the Industrial Engineering Dep ment, and in that position he supervised the application electrical apparatus in the paper, lumber, textile, rub printing, machine tool, cement, and food industries, la becoming engineer of the Paper and Textile Division.

In 1947, a year before retirement, Mr. Rogers was appoin Engineering Consultant of the Paper and Textile Divisi and in that capacity he continued as adviser and counsel until he retired, May 1, 1948.

Since retirement Mr. Rogers had prepared a complete A plication Data Book on the Paper Industry.

David Moffat Myers

David Moffat Myers, Consulting Engineer, died at home, 3 Cliff Way, Larchmont, N. Y., on January 20. was 75 years of age.

Mr. Myers was a prominent consulting engineer in N York for many years, and was a specialist on industrial pov supply. He was born in Owasco, N. Y., and was the son the Rev. Alfred E. Myers and Mary Moffat of Brook Heights. He attended Collegiate School, New York, a then took the degree of Mechanical Engineering at Colum in 1901. In 1911 he married Emily Niles Huyck of Alba who died in 1912. He married Jennette Kennedy of Portla Ore., in 1923.

Mr. Myers began his career as mechanical engineer, U. Leather Co., 1901–06; was in private practice 1906– partner in the firm of Griggs and Myers 1915–25; late member of the firm of Orrok, Myers and Shoudy, and th

partner in the firm of Myers, Fuller and Addington. He was Consulting Engineer, Bureau of Yards and Docks U. S. Navy, and for the past 8 years Consulting Engineer, New York Board of Water Supply. At the time of his death he was consultant with the firm of Seelye Stevenson Value & Knecht.

During World War I Mr. Myers served as a volunteer with the U. S. Fuel Administration, being appointed Advisory Engineer and Chief of the Fuel Engineering Section which he organized.

Mr. Myers was also an author and an inventor. Among his books were "Factory Power Plants"; "The Power Plant"; "Cost Cutting for Industrial Power Plants"; "Reducing Industrial Power Costs"; as well as many articles and papers for technical publications and organizations. His inventions included furnaces for special fuels; the acquaknot speed indicator for boats, a sail slide guide, and the aeroknot indicator of velocity of the wind. He was also a talented amateur artist.

Mr. Myers is survived by his wife, Mrs. Jennette Kennedy Myers, of Larchmont, and by a sister, Miss Susanna Myers, a brother, Rev. James Myers, both of New York, and a brother, Alfred Stuart Myers of Montclair, N. J.

RECENT BOOKS

Chromatography. By Edgar and Michael Lederer. Elsevier Press, Houston, Tex., 1953. Cloth, 6 × 9, 46 pages. $9.25.

A review of the principles and applications of chromatography prepared for research and industrial chemists, including an unusually complete bibliography.

Chromatography is an analytical method for the purification and separation of organic and inorganic substances, especially useful for the fractionation of complex mixtures.

Among the major subjects covered are adsorption in exchange, partition chromatographies, chromatography of organic substances such as alcohols, aldehydes, halogens, synthetic dyestuffs, carbohydrates, proteins and natural pigments, and chromatographs of inorganic substances, including paper chromatography.

Phillips Paper Trade Directory of the World—1954. S. C. Phillips & Co., Ltd., Graham House, 3 Tudor St., London, E.C. 4, England. Cloth, 5 × 8½, 810 pages. £1.19.6.

An excellent directory of pulp and paper companies located in countries throughout the world with special emphasis on the industry in the United Kingdom.

Of special interest are the pages devoted to subjects of useful application such as British standard sizes for paper and boards, British paper trade customs, and a glossary of trade terms.

Annuaire de la Papeterie Universelle—1954. Lhomme & Argy, 9 Rue Lagrange, Paris 5, France. Cloth, 6 × 9, 770 pages. 2000 Frs.

A directory of paper and pulp mills located in countries throughout the world with special emphasis on companies located in France and its dominions.

In addition to the listing of mills a section is devoted to paper trade marks and to trade associations located in France.

Inorganic Thermogravimetric Analysis. By Clement Duval of the Sorbonne in Paris, France. Elsevier Press, Houston, Tex., 1953. Cloth, 6 × 9, 531 pages. $11.

This volume is the first presentation in book form of thermogravimetric analysis and the thermo-balances, an instrument which automatically traces on photographic or ordinary paper a curve showing the gain or loss of weight of a material as a function of its temperature, while it is being tested.

Detailed consideration is given to the determination of sixty elements found in compounds and mixtures. Of special value are the pyrolysis curves of derivations of these elements.

Developing Farm Woodlands. By John F. Preston, Former Chief, Forestry Div., U. S. Soil Conservation Service. McGraw-Hill Book Co., New York, 1954. Cloth, 6 × 9, 386 pages. Illustrated. $4.50.

The present book is one of the McGraw-Hill Rural Activities Series and was prepared by the author to provide farmers and students simple but complete instructions for woods operations that will provide a profitable woodland enterprise as a part of the farm business.

Included in the book are such subjects as growing wood as a farm crop, protecting the woods, starting the farm forest, planting, weeding, and releasing young trees, thinning tree crops, pruning tree crops, cutting, marketing, management.

Included also is a bibliography, glossary, volume tables, log rules, modified acreage grid, sample contracts, taxation laws, and assistance from the U. S. Forest Service.

Labor Relations Work Kit. By Lawrence Stessin. National Foremen's Institute, New London, Conn. Loose-leaf, embossed paper binder, 8½ × 11, 215 pages. $8.00.

The Work Kit is compiled by the editors of the Employee Relations Bulletin issued by the National Foremen's Institute. It is prepared in an attempt to put the labor relations and personnel man in touch with some of the more successful techniques worked out by many companies. It contains a wide range of topics of which the following are representative: absenteeism, publicizing grievance machinery, company rules and policies, accident consciousness, in-plant safety measures, overtime, lending libraries, physical examination, company history, employee picnics, group insurance, cooperation in improving product quality, disciplinary systems, charitable organizations, bulletin boards, union stewards, strikes, negotiations.

Conference Leaders Source Book. By Samuel N. Morrison and Staff. National Foremen's Institute, New London, Conn. Loose-leaf, fabrikoid binder, 8½ × 11, 500 pages. $15.50.

The contents of the loose-leaf "Conference Leaders Source Book" is essentially a manual for the use of executives interested in training programs. It is divided into a number of sections: Introduction to the Conference Method (Executive Training at the Supervisory Level), Preparations to Be Made by the Conference Leader, Conference Tools (Questions, Case Studies, Demonstrations), Discussion Procedures (Rules of Discussion, Stimulating Participation), Follow-Through (Getting Action), Solving a Business Problem (Resolving a Conflict), Films and Training Devices, Conference Outlines, Costs and Control, Personnel, Job Relations, Job Instruction, Safety and Health, Rating Foremen.

The books reviewed above may be procured from the Technical Association of the Pulp and Paper Industry, 155 E. 44th St., New York 17, N. Y.

TAPPI DIVISIONS AND COMMITTEES

Reports of Activities

Semichemical Pulping Committee

Minutes of Meeting of TAPPI Semichemical Pulping Committee, The Morrison Hotel, Chicago, Ill., Sept. 14, 1953

The following members were present: J. N. McGovern, W. W. Marteny, W. T. Butler, R. G. Coker, J. E. Sapp, D. J. MacLaurin, C. K. Textor, J. S. Hart, S. A. Woodruff, E. D. Cann, E. L. Shriver, G. C. Kimble, C. W. Converse, E. Beauvais (representing R. G. Knechtges), and G. W. Mead II.

The minutes of the previous meeting, Feb. 17, 1953, were presented and accepted.

Standard Terms (C. K. Textor, Chairman). We have talked with R. G. Macdonald concerning the difficulty of getting definitions accepted. The first step is to get this committee to approve them and they will then go to a TAPPI standing committee. Ten replies were received on the preliminary definition report out of nineteen inquiries. Not one definition was accepted unanimously, but indications are that the definitions were not far from being acceptable to the group. A long discussion ensued in which the definitions were discussed individually and all present expressed their opinions. After rewriting, the definitions will be resubmitted to the full committee.

Equipment Survey (J. E. Sapp, Chairman). The questionnaire on semichemical pulp mill equipment was issued in early July. It was sent to about 25 mills. Replies have been received from 15 to date, representing about 1100 daily tons. Nearly all end uses of semichemical pulp are represented in the replies, including corrugating board, coating raw stock, glassine, insulation board, newsprint, match board, single bleached lined Manila, solid wood pulp board, greaseproof, book paper, panel board, etc. The committee will follow up on those that have not replied with another request. Five other United States and Canadian mills were added to the list to which the survey is to be sent. The subcommittee will arrange to meet and analyze the data preliminary to its presentation as a paper.

Pulping Measures (R. W. Brown, Chairman). The following report was submitted by the subcommittee chairman, who was unable to be present. Since the last meeting held in February, 1953, the Pulping Measures Subcommittee has worked up a short questionnaire covering the subject of measurement of: (1) cooking degree, (2) chip softness, (3) chip defibering, and (4) liquor analysis. Through the excellent cooperation of the Equipment Survey Subcommittee this questionnaire was attached to their questionnaires and circulated to all mills making semichemical grades. We are now awaiting the replies from this questionnaire. These should provide a guide to setting up standard methods for measuring these properties.

The subcommittee has exchanged views with Lyman Aldrich of the Permanganate Number Subcommittee of the Chemical Methods Committee. They plan to proceed with publication of a revised method for permanganate numbers less than 20. We plan to continue to work closely with this group. The report made by Mr. Rasch at the February meeting on the Hammermill permanganate test is being expanded into a formal paper which will be submitted to TAPPI for publication. We hope to have the results of the questionnaire ready for presentation in February, 1954.

Bibliography and Review (J. N. McGovern, Chairma
The subcommittee has applied for a grant to bring The
stitute of Paper Chemistry Bibliography on Semichemi
Pulping up-to-date and to index it. The committee has
ready published a list of 1952 articles bearing on semichemi
pulping. It is planned to expand the activities of the co
mittee to include translations of important foreign articles

The meeting turned to new business. J. N. McGovern s
gested that several papers are needed yet to fill out the s
sion at the annual meeting. J. S. Hart reported that th
have requested permission to publish a paper on the use of
laboratory Dyno-pulper for evaluating degree of cooki
D. J. MacLaurin announced that his group expects to pres
a paper on "An Orienting Study of the Effect of the Neut
Sulphite Semichemical Cook on the Hemicelluloses of Asp
Wood." Glenn Kimble stated that his group will presen
paper on "The Effect of Cooking Conditions on Neut
Sulphite Pulping of Sweetgum." E. H. Shriver offered
investigate a paper from his group on "Properties of Se
chemical Pulp." E. D. Cann said he would contact t
FSPRA group for a possible paper.

The desirability of engaging in new activities was discuss
The subjects of corrosion and spent liquor recovery were s
gested as possibilities. It was agreed informally that
present activities were sufficient. An informal discuss
was held on points of general interest. Some of the subje
brought up were as follows: uncontrolled variation in p
quality, digester corrosion, oxalic acid precipitation in liq
tanks, foam on the paper machine, flat crush testers, p
troubles, liquor recovery, and sulphonation under differ
conditions. The meeting was adjourned at 3 p.m.

***Semichemical Pulping Session at Alkaline Pulping Co
ference***

The Semichemical Pulping Committee helped arrange
session on semichemical pulping at the Alkaline Pulping C
ference of TAPPI, Houston, Tex., Nov. 18–20, 1953. J.
McGovern was chairman of the session.

The program consisted of three types of presentation
broad interest as follows:

I. Formal Technical Papers
   1. "Continuous High Yield Kraft Pulping of Douglas-
   Lumber Waste," by D. J. MacLaurin and J. F. Whal
   Institute of Paper Chemistry. The paper was p
   sented by Don MacLaurin.
   2. "The Influence of Fiberizing Variables in Produc
   Semichemical Pulp in a Commercial Disk Mill,"
   F. A. Aflenzer, Forest Products Laboratory. T
   paper was presented by J. N. McGovern.

   These two papers will appear in *Tappi*.

II. Informal Practical Papers
   1. "Application of Vapurge to Continuous Pulping,"
   L. G. Durant, Pandia, Inc., New York. The princi
   of Vapurge were decided briefly and their applicatio
   the Chemipulper described. The necessary equipm
   is being developed for a pilot plant demonstrati
   although trials have not yet been made.
   2. "Application of the Press-O-Finer in Semichem
   Pulping," by William Nelson, Green Bay Paper & P
   Co., Green Bay, Wis. The steps leading to
   adaptation of the screw press of the French Oil M
   Machinery Co. to semichemically cooked chips w
   described. The application was primarily to exp
   spent liquor from the chips, but advantages in the w
   of reduced total fiberizing energy and improvement
   some pulp properties were also obtained.

List of Mills Having Semichemical Pulping Facilities (Based on Lockwood's Directory and Paper Trade Literature)

	Type of pulp	Daily capacity, tons
Mills operating in the United States:		
American Box Board Co., American Pulp & Paper Div., Filer City, Mich.	Unbleached	360
Camp Manufacturing Co., Franklin, Va.	Unbleached	50
Champion Paper & Fibre Co., Canton, N. C.	Bleached	25
Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.	Bleached	70
Container Corporation of America, Circleville, Ohio	Unbleached	35
Cornell Paperboard Products Co., Cornell, Wis.	Unbleached	25
Fibreboard Products, Inc., Antioch, Calif.	Unbleached	145
Gaylord Container Corp., Bogalusa, La.	Unbleached	135
Green Bay Paper & Pulp Co., Green Bay, Wis.	Unbleached	150
Groveton Papers Co., Groveton, N. H.	Unbleached	150
Hammermill Paper Co., Erie, Pa.	Bleached	40
International Paper Co., Southern Kraft Div.		
Bastrop, La.	Unbleached	490
Georgetown, S. C.	Unbleached	430
The Mead Corp.		
Harriman, Tenn.	Unbleached	100
Knoxville Tenn.	Unbleached	75
Lynchburg, Va.	Unbleached	125
Nashville, Tenn.	Unbleached	70
Sylva, N. C.	Unbleached	160
National Container Corp.		
Big Island, Va.	Unbleached	150
Tomahawk, Wis.	Unbleached	250
New York & Pennsylvania Co., Lock Haven, Pa.	Bleached	35
North Carolina Pulp Co., Plymouth, N. C.	Unbleached	100
Otsego Falls Paper Mills, Inc., Otsego, Mich.	Unbleached	100
Rhinelander Paper Co., Rhinelander, Wis.	Bleached	40
Riegel-Carolina Corp., Acme, N. C.	Bleached	25
Sonoco Products Co., Hartsville, S. C.	Unbleached	125
Stone Container Corp., Coshocton, Ohio	Unbleached	25
Waldorf Paper Products Co., St. Paul, Minn.	Bleached and unbleached	160
Watervliet Paper Co., Watervliet, Mich.	Bleached	10
West Virginia Pulp & Paper Co.		
Covington, Va.	Unbleached	150
Mechanicville, N. Y.	Bleached	85
Mills operating in Canada:		
Abitibi Power & Paper Co., Ltd., Sturgeon Falls, Ont., Can.	Unbleached	110
Bathurst Power & Paper Co., Ltd., Bathurst, N. B., Can.	Unbleached	200
Richmond Pulp & Paper Co. of Canada, Ltd., Bromptonville, Que., Can.	Unbleached	25
Mills under construction:		
Crossett Co., Crossett, Ark.		
Union Bag & Paper Corp., Savannah, Ga.		
West Virginia Pulp & Paper Co., Charleston, S. C.		

III. Panel Discussion

The panel had Cover Porter, Southland Paper Mills, Lufkin, Tex., as a moderator and had the following members: Don MacLaurin, Institute of Paper Chemistry, Appleton, Wis.; Junius Sapp, Gaylord Container Corp., Bogalusa, La.; Myron Kuhlman, Fleming & Sons, Dallas, Tex.; Phalti Lawrence, Champion Paper & Fibre Co., Hamilton, Ohio; Malcolm Pineo, Brunswick Pulp & Paper Co., Brunswick, Ga.; and J. N. McGovern, Forest Products Laboratory. The subject considered by the panel was "Considerations for Hardwood Utilization at Southland." Some points of interest were: (a) general agreement that the most promising approach was through bleached semichemical pulp, (b) the use of at least 25% semichemical pulp would be possible in all grades, (c) improved printing should be obtained in board grades, (d) washing capacity will be lower with semichemical than chemical pulps (e) separate refining of semichemical and kraft pulps is probably necessary, and (f) centrifugal cleaners are desirable with semichemical pulps.

Members of Semichemical Pulping Committee

J. N. McGovern, Chairman, Forest Products Laboratory, Madison 5, Wis.
C. W. Converse, Secretary, Sprout, Waldron & Co., Inc., Muncy, Pa.
R. W. Brown, Hammermill Paper Co., Erie, Pa.
W. T. Butler, Abitibi Power & Paper Co., Ltd., Sault Ste. Marie, Ont., Can.
E. D. Cann, Howard Smith Paper Mills, Ltd., Cornwall, Ont., Can.
R. G. Coker, Sonoco Products Co., Hartsville, S. C.
P. L. Gilmont, Crossett Paper Co., Crossett, Ark.
J. S. Hart, Pulp & Paper Research Institute of Canada, Montreal 2, P. Q., Can.
Gerald Haywood, West Virginia Pulp & Paper Co., Luke, Md.
G. C. Kimble, Union Bag & Paper Corp., Savannah, Ga.
R. G. Knechtges, American Box Board Co., Filer City, Mich.
D. J. MacLaurin, Institute of Paper Chemistry, Appleton, Wis.
W. W. Marteny, National Container Corp., Tomahawk, Wis.
S. R. Parsons, Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.
J. E. Sapp, Gaylord Container Corp., Bogalusa, La.
E. H. Shriver, The Mead Corp., Chillicothe, Ohio
J. A. Staidl, Camp Manufacturing Co., Franklin, Va.
D. G. Terry, The Mead Corp., Chillicothe, Ohio
C. K. Textor, The Bauer Brothers Co., Springfield, Ohio
S. A. Woodruff, Battelle Memorial Institute, Columbus, Ohio

Equipment Survey Subcommittee

J. E. Sapp, Chairman — J. A. Staidl
R. G. Coker — D. G. Terry
D. J. MacLaurin

Semichemical Pulping Measures Subcommittee

R. W. Brown, Chairman — G. C. Kimble
W. T. Butler — R. G. Knechtges
E. D. Cann — G. W. Mead II
J. S. Hart

Standard Terms Subcommittee

C. K. Textor — Gerald Haywood
P. L. Gilmont — W. W. Marteny

Bibliography & Review Subcommittee

J. N. McGovern, Chairman — S. A. Woodruff

News Note Subcommittee

C. W. Converse, Chairman

Pulp Testing Committee Meeting

The meeting of the Pulp Testing Committee of TAPPI was called to order at 9:15 a.m. at the Hotel Monticello, Longview, Wash., by Frank Caskey, chairman of the committee. Members in attendance were: Mr. Christoferson, Mr. Sangder, Mr. Clark, and Mr. Magnusson. Frank Dinger of Puget Sound Pulp & Timber Co. was a guest of the committee.

Mr. Caskey opened the meeting by reviewing the projects undertaken by the committee last year. Three main activities were handled: (1) revision of Standard T 210 m-45 which involved the establishing of a standard temperature and method for controlling the temperature of ovens used for the moisture determination of dried pulp; (2) the establishing of two suggested methods for fiber classification; (3) the investigation of several dirt count procedures. The last item has not been completed and will be continued as a project this year.

The data from the dirt counting investigation conducted last year have been assembled and referred to Mr. Christoferson for further review. When this review is completed and the data are in proper form, such will be sent to the Statistical Committee of National TAPPI. It is planned that the Statis-

tical Committee will review the data and determine the practicability of dirt counting as proposed by last year's committee.

A request had been received by the committee to take as a project the setting up of the necessary mechanisms for obtaining aluminum foil to be used for Mullen tester calibration. Mr. Caskey expressed his feeling that this was not a project for the Pulp Testing Committee and should be referred to the Paper Testing Committee. All members of the committee agreed to this since the Mullen test is basically a paper testing procedure. A motion was made and passed that this project be referred to Mr. Clark with a request that the problem be referred to the Paper Testing Committee.

Further it was pointed out that several companies have not changed their Mullen testers to agree with the new standard. This was discussed briefly and it was agreed that each member should encourage the change of all Mullen testers and testing methods to agree with the new revised TAPPI Standard.

Mr. Caskey suggested as a possible project the study and development of a standard method for determining consistency of pulp. He referred, in particular, to a recent definition of consistency published in "Pulp and Paper Manufacture" Vol. 2, page 188. This definition refers to pulp *consistency* as the per cent of *air-dried* fiber in a combination of fiber and water. It was noted further that pulp *consistency* has been defined as the per cent of *oven-dry* weight in a combination of fiber and water. These definitions are not agreed to as being generally acceptable. All members of the committee agreed that a clarification of the definition of pulp consistency was necessary. After considerable discussion relative to the various methods, which have been used in the past and are presently in use by the various mills, for determining pulp consistency, it was agreed that each member of the committee turn in, at the next meeting, a suggested method for determining pulp consistency. These methods will then be reviewed and used as a basis to develop a method which could be published as a TAPPI Standard.

A suggestion was made that a possible project for this year could evolve around a revision of TAPPI Standard T 200 m-45 Laboratory Processing of Pulp (Beater Method). Since this is a very controversial subject and there is very little agreement among the several laboratories in this area or throughout the pulp and paper industry, it was suggested that the members of this committee test in their own laboratories a sample of a reference pulp. The results from this testing would then be reviewed and the conclusion from this review could provide a starting point for a sound discussion of possible revisions to the TAPPI Standard for laboratory beater testing. A general discussion followed for the next hour. The various points discussed might be summarized as follows: (1) The Valley beater or any other beater method as used at present is inadequate for evaluation of pulp and a new view or method is needed. (2) The laboratory beater will answer only one question, that is, how easily does a pulp beat? (3) Most of the members agreed with Clark's philosophy concerning the fundamentals for pulp evaluation, these are: (a) rate of beating, (b) intrinsic fiber strength, (c) softness when wet, (d) fiber fineness (e) weighted average length of fiber, and (f) fiber cohesiveness.

The discussion pertaining to the laboratory beater ended with the following conclusions: (1) that a sample of reference pulp would be provided and sent out to each member of the Pulp Testing Committee so that each member could test this pulp using their current methods (the data gathered from this testing would then be reviewed at the next meeting); and (2) that the problem at hand would be to study changes needed in the present testing methods, to look into the future with the object of initiating a change of pulp testing methods to a more scientific basis.

Another item brought up for discussion once more was the possibility of a reference pulp which would be made available to the various laboratories as a basic standard particularly f beater testing. This possibility was discussed several tim last year, but was not taken on as a definite project. M Caskey had found that the Everett Pulp and Paper Co. wou be willing to furnish pulp, packaged in small lots, which cou be sold to the various laboratories for standardization pu poses. They, however, are not able to provide the stora and handling facilities. Mr. Clark added that at present had not been possible to find facilities for storing and handli this pulp. Further study of the possibility of obtaini adequate handling and storing facilities will be made by M Caskey and Mr. Clark.

NORVAL MAGNUSSON, *Secretary*

Non-Fibrous Raw Materials Testing Committee

Report of Opaque Pigments Subcommittee for 1953

The subcommittee comprises:

W. R. Willets, *Chairman*, Titanium Pigment Corp.
V. A. Belcher, New Jersey Zinc Co.
H. C. Brill, E. I. du Pont de Nemours & Co.
F. H. Denham, R. T. Vanderbilt Co.
F. O. Sundstrom, American Cyanamid Co.

No meetings of the subcommittee have been held during th year but considerable correspondence and long distance tel phoning have probably accomplished as much as form meetings would have. In his interim report of March 1 1953, the chairman stated that there seemed no reason wh all paper fillers and coating pigments should not be includ in an over-all method with suitable submethods as neede However, because of the difficulty that was being experience in developing methods for clay it wasn't deemed feasible try to write such comprehensive methods at this time. Ther fore the decision was reached to attempt to develop metho for opaque pigments independently, but to consider careful what had already been done on the clay and calcium sulpha methods so as to make the opaque pigments method confo as closely as possible.

With this thought in mind a copy of the proposed meth for clay was obtained from C. G. Albert, chairman of th Clays Subcommittee, duplicated and circularized to th Opaque Pigments Subcommittee on June 5, 1953, for co ment and to form a basis for methods for opaque pigment By-and-large, prompt response was obtained and the follo ing notes represent the opinions of Messrs. Belcher, Bri Denham, and Willets as summarized by the chairman.

1. *Sampling.* Opaque pigments are generally shipped 50-lb. bags, so methods applying to bulk shipments of cla would not be applicable. Furthermore the collection of gross sample of 25 lb. (as recommended for clay) seems u necessary. Individual samples of 100 grams should be remove from each bag sampled. The number of bags so sample shall not be less than 1% of all those in the shipment and n less than 6 bags for lots of 6 bags or more. The gro sample shall be at least 600 grams.

2. *Moisture.* The method proposed for clay in which 100-grams sample is dried at 105 to 100°C. until consta weight is reached is satisfactory for all opaque pigment although this sample may be larger than necessary. (AST D 280–33 suggests 3 to 5 grams). As a quicker alterna method for titanium dioxide (but not for zinc pigments) th use of a muffle furnace at temperatures up to 1000°C. is al suggested.

3. *pH.* Messrs. Brill, Denham, and Willets feel that on an electrometric method for pH is necessary but instead using 20 grams of sample in 80 ml. of water (as recommende for clay) think 10 grams to 100 ml. or 90 ml. would b sufficient. (ASTM D 1208–52 T calls for 5 grams of pi ment in 50 ml. water.)

W. R. Willets, Titanium Pigment Corp., Chairman, Opaque Pigments Subcommittee

Mr. Belcher notes that the method suggested for clay would be satisfactory but that his company uses a method for titratable alkalinity by agitating the pigment with water at a definite temperature for a specified time, filtering, and then titrating the filtrate with a standard sulphuric acid solution using methyl orange as an indicator.

4. *Grit.* Although there is considerable doubt as to whether there is any correlation between screen tests for grit and grit in the filled or coated sheet such "sieve tests" are simple to make and are widely used. There are numerous tests for this but essentially they all involve a standard mixing (or shaking in water) followed by controlled washing on a 325-mesh sieve (sieves of larger openings would have no significance as far as opaque pigments are concerned). The type of mixing used, the nature and extent of washing, and the like all play a part in the amount of residue left on the screen. The procedure suggested for clays seems to be far more elaborate and time consuming than would be necessary for opaque pigments.

Probably a better method involves the preparation of a standard coating color using starch or casein as the binder under controlled conditions of mixing and the like and applying the color at a fixed wet film thickness by means of a Bird film applicator. After drying the surface can be compared with standard samples. Mr. Brill suggests coating the paper to be tested under the conditions similar to that used in the paper mill. Any such method, if it can be reduced to carefully stated procedures and evaluated according to a generally accepted set of standards, would be desirable, but there would probably be some difficulty in expressing it in standard procedure and specification form.

5. *Particle Size Distribution.* The consensus of Messrs. Belcher, Brill, Denham, and Willets is that no method for particle size determination should be included in a TAPPI procedure for opaque pigments. This opinion is based on the fact that opaque pigments are all synthetic and must be manufactured within limited uniform particle size ranges to insure the development of hiding and brightness. The particle size method which has been suggested to the Clay Testing Subcommittee (involving gravity settling techniques only suitable to materials above 1 mu in particle size) would not, in any event, seem applicable to opaque pigments. There seems a great deal of question if any mill would use it as a basis for specification buying of clay, since it is so involved that experimental coating would tell the same story and more with less effort. While particle size distribution is of interest from a fundamental point of view and for purposes of control in pigment manufacture it is the practical performance of the product that gives the measurement of quality. There is at present no foolproof method for particle size (especially distributions below 1 mu).

6. *Viscosity of (Water) Slurry.* There is little or no correlation between the viscosity of a water slurry and the viscosity of the final coating color. The viscosity of a water slurry will depend on the degree of deflocculation which in turn will depend on the type and amount of deflocculant used, as well as on the type of pigment in question. A simple water absorption test can be made by determining the volume of water required to make a fluid slurry with 100 grams (or some suitable weight) of pigment. However, this also has little real value because it applies only to "water-dispersible" types and if a dispersant is used in the water the water absorption of "nonwater-dispersible" types can be greatly lowered. This test apparently has no real significance.

7. *Sedimentation Tests.* The consensus of Messrs. Belcher, Brill, and Willets is that this test (which consists essentially of applying a controlled amount of work to a deflocculated slurry and determining the settling rate) has no practical significance and is unnecessary as far as opaque pigments are concerned. It would have no relationship to settling in a final coating color.

The test suggested for clay, in any event, would seem too elaborate and cumbersome for opaque pigments. If the pigment is of the "water-dispersible" type a suspension can be prepared by stirring a given weight of pigment in a specified volume of water for a given length of time, transferring to graduates, pipetting off the upper layer after the specified settling time, and determining the amount of pigment still in suspension. If the pigment is of the "nonwater-dispersible" type the test would require the use of a deflocculant in the slurry water. While tests of this kind have been widely used they have never been shown to correlate with actual pigment application as fillers or in coating.

8. *Dry Brightness and Color.* The test as suggested for clay might prove suitable for opaque pigments. It has been suggested that the use of a green filter in the brightness tester would give results more in line with the human eye than does the use of a blue filter, and certainly the green filter has been used for "brightness" tests for years by the paint industry and almost all other industries except the paper industry. Pressures in excess of the suggested 30 p.s.i. have been suggested as giving better results with opaque pigments. The brightness in most cases reflects the degree of packing and may or may not correlate with practical application when the pigment is used in a vehicle. Here again it has been suggested that the preparation of standard coating colors and their application under controlled conditions, with comparisons with standards, would tell much more.

9. *Hiding Power.* Methods here would also involve the preparation of standard coatings and application over white and black charts at controlled film thickness. Contrast ratio would be determined as is done for paints at present.

If opacity by transmitted light is desired this could be done by applying the coatings to a transparent film and then determining opacity with an Opacimeter.

Any method involving the loading of paper with opaque pigments would be very long and involved and almost impossible of standardization.

While undoubtedly some method can be worked out under standardized conditions for "hiding power" there is none available in the literature at present which seems directly applicable for opaque pigments in paper coatings.

10. *Chemical Analysis.* A method for determining titanium dioxide to replace T 627 m-45 involves reduction with aluminum under much simpler conditions than the use of a Jones reductor and amalgamated zinc as now specified. Copies of this were distributed to the subcommittee and met with approval. The same method is being considered by the TAPPI Chemical Methods Committee for application to the analysis of paper for titanium dioxide, and apparently meets with approval.

Total zinc can be determined according to ASTM D 1224–52 T.

To summarize: The Opaque Pigments Subcommittee is generally agreed that certain methods which have been suggested for the testing of clays (e. g., grit, particle size distribution, water slurry viscosity, and sedimentation) have little or no practical application as far as opaque pigments are concerned. Details of methods for opaque pigments will have to be worked out and the whole put in suitable TAPPI format. This will probably take considerable time but the subcommittee seems agreed in principle as to what should be covered.

William R. Willets, *Chairman*

LOCAL SECTION ACTIVITIES

Reports of Meetings, Personnel, and Events

Pacific

Pacific Section of TAPPI met in Everett, Wash., Jan. 19, 1954, with an attendance of approximately 155. In the absence of Fred Weleber, chairman, E. H. Nunn presided over this meeting. Lauren Foreman acted as moderator for the afternoon technical session.

During the morning, Weyerhaeuser Timber Co. and Everett Pulp & Paper Co., Division of Simpson Logging Co., were open for mill visitations.

The afternoon technical meeting was held at 2:00 P.M. in the Everett Elks Lodge and the following four papers were presented:

1. "Start-Up Problems at a New Kraft Pulp Mill," by Kenneth Chapman, Weyerhaeuser Timber Co.
2. "Corrosion Problems in the Pulp and Paper Industry, by Raymond B. Seymour, Atlas Mineral Products Co.
3. "Strength Development Through Stock Refining as Influenced by Certain Variables," by Frank E. Caskey, Crown Zellerbach Corp.
4. "Mill Control of Beating and Refining," by James d'A. Clark, Consulting Engineer.

The technical meeting was followed by a social hour and dinner. After dinner, Professor Richard D. Taylor of the Department of Civil Engineering, University of Washington, showed slides from a recent visit to Israel. The meeting was adjourned at approximately 9:00 P.M.

The papers by Messrs. Chapman, Seymour, and Clark follow this report. That by Mr. Caskey will appear in the Technical Section of *Tappi* in the near future.

H. B. PETERSEN *Secretary-Treasurer*

Start-up Problems at a New Kraft Pulp Mill

Kenneth Chapman

THE problems involved in starting up a new, modern chemical plant, such as a kraft-type pulp mill, are many and varied. In order to keep the presentation in a reasonable sequence, the three major brackets of this paper can be divided into: personnel, equipment, and operation. Each of these three will then break down into numerous divisions and subdivisions.

Personnel problems at the new mill, seemingly quite severe before the start-up, have ironed out very well and the mill now has a good crew working smoothly together as a team. Supervisors were all men of considerable experience, who had been with Weyerhaeuser for a long time. Three had had kraft experience, while the fourth had been up through all positions in the company's Everett sulphite mill. The cooks were all experienced kraft men; three from the Longview mill and one from Springfield. These men had all broken in at cooking but none of them were really experienced cooks. They did, and are doing a fine job.

Bleaching—at this mill the top job—was a rather hard place to fill. Longview's recent expansion, plus the fact that Springfield has no bleach plant, narrowed the selection to Longview men (below bleacherman), Everett sulphite, or outside sources. It finally worked out to one from Longview, who had not had much actual bleaching experience, and three from Everett, all of whom had had much experience in sulphite bleaching. With a new type of pulp and new, strange equipment to them, these men did an outstanding job in getti the mill into early production with top grade pulp.

Liquor makers and kiln operators were quite green a for the most part, had only a relatively short break-in peri at Longview. The Longview training program was taki place along with ours, as men were sent here on the cooki and bleaching jobs. The liquor making department start up so smoothly that we were hardly aware of it.

In the powerhouse and recovery department, which is r in this writer's bailiwick, the operators were, fortunate all experienced men. Two of the shift engineers came fr the Everett sulfite; one from Longview; and one from n B. Several of the firemen also had had previous recove boiler time.

The machine room crew really did not present much o problem at all, as they were obtained almost entirely fr the sulphite mill. This extraction of many of their top n chine men was a severe blow to the machine over there a the kraft mill certainly realizes the contribution made the other mills in the company—and especially the Ever sulphite mill in producing so many qualified and capable ope tors. Without them, our start-up would have been far m difficult.

The remainder of the operating crews were, for the m part, selected locally, on the basis of their schooling, appe ance, references and so on. We have been extremely for nate here in having been able to select a uniformly smo performing group.

The maintenance department personnel is mixed, so with pulp mill experience, but more without. This, ag is not in the author's personal area of activity.

Now as to equipment. In starting up, one of the fi items was to warm up the digesters according to the form by the lining people, to give the carbon brick lining a f chance. Water blows, at 40, 60, 80 and 100 lb. pressure w next tried to get the blow steam condenser and the accompan ing equipment shaken down. A little trouble was experienc here, due to the newness of the blow valves. Several mot were burnt out but, with liberal applications of oil on t sleeves and much operating, these valves have turned in their normal, reliable rut. Another item requiring attenti was the used catch-all pump which drains the area outsi

The meeting of the Pacific Section, Everett, Wash., Ja 19, 1954

KENNETH CHAPMAN, Weyerhaeuser Timber Co., Everett, Wash.

the tube bundle and case inside the blow steam condenser. After a blow or two, the safety on the blow tank valve would vent nearly the entire blow. The condenser was full of water. As soon as we replaced the impeller on the catch-all pump the operation became normal.

At the risk of becoming unpopular with valve manufacturers, or the engineering department, a mention of the use of rubber flex or pinch valves might be in order here. These valves are used extensively in this mill and many are doing an excellent job. However, there are places where they have not done well for us. One notable spot was in the discharge of the stock pump from the blow tank. This was an air diaphragm controlled valve. Due to the pulsation in the rubber section around the squeeze bars, which the operating mechanism could not hold, the entire line pounded and shook unmercifully. It had to be removed within a few minutes after we tried to start up. Control valves of this type at the green liquor flow to the slaker, to the green liquor clarifier, and on bleach liquor control in the bleach plant have all given this pulsating type trouble. They are also capable of collapsing when used on pump suctions, such as to the transfer pumps from the dissolving tank under the boiler. Another shaking pipe problem was solved recently by a small change in the instrument piping. The charging line and pump rattled and banged terribly, even when throttled down. It has done well, however, since the automatic valve on the suction side opens before the pump starts instead of after.

The chip conveying system has done well. One bad plug-up in the main tower was followed up by the installation of kick-out switches at each transfer point, so that if the chips pile up and hit the arm of the switch the feeding belt and all feeders and belts behind it stop. Extensive use of interlocks is used throughout the mill, not only on conveyors but on washers, shredders, mixers, stock pumps, etc.

To get back to the washers; some trouble was experienced here, due to several interrelated circumstances. One was the odd stock flow from the blow tank caused by the flex valve and later by a butterfly valve. Second was the instrumentation problems. The consistency controller could not be set until we got and held the consistency we wanted, but we could not get the consistency we wanted until the consistency controller helped us out a little. Also entering the picture was the valve settings on the knotter dilution pump.

The problem mentioned above—of getting the proper valve settings on the instrument dials to match the actual settings on the valves below, and also to know what that setting meant in terms of washer operation—was one of our most realistic

Walter Holzer, Crown Zellerbach Corp.; Robert I. Thieme, Scott Paper Co.; E. H. Nunn, Crown Zellerbach Corp.; H. B. Petersen, Hercules Powder Co.; Loren Forman, Scott Paper Co.; J. L. McCarthy, University of Washington; James d'A. Clark, Longview, Wash.; Frank E. Caskey, Crown Zellerbach Corp.; Frank Hamilton, Everett Pulp & Paper Div., Simpson Logging Co.; Kenneth Chapman, Weyerhaeuser Timber Co.; and Richard G. Tyler, University of Washington

problems and the instrument crew, in finally getting everything lined out, did a grand job—although it meant many a 24-hr. day for them. They were not alone in this, however, as most everyone got in some pretty long hours.

As you know, this mill is unique in having all the pulping functions in one building, and it is very close coupled. Thus it is that after the final brown stock washer thickener the stock drops into a consistency regulator and then into five Lindblad screens. This system kept us on the "go" for a while. The drop from the consistency regulator to the Lindblad screens is not great, so a larger get-away and manifold header had to be installed in order to take care of the slugs or surges that came off the washers at the time of blows, or when the butterfly control let go, or when the stock pump was back-flushed. This worked fine. The stock got to the Lindblad screens all right, but when a slug hit, it kept right on over the top and all over the floor. This was finally handled by installing exterior overflows from the backsides of the Lindblad vats, and leading the overflow to the six flat screens. All this has been in the nature of expediency, as it is hoped that a more even flow of stock from the blow tank can be obtained by some additional equipment. A steadier flow throughout the whole brown stock system would reduce the magnitude of almost all of these problems.

Another spot of trouble came as we got out from the Lindblad situation and that was that the accepted stock pump could not handle all the stock from all the screens. A larger sump on the pump, together with smoother operation, has eliminated this problem.

The washer thickener after the screens next entered the picture, by dropping the sheet at odd and erratic intervals, and by running all over the floor. A large overflow from the vat into the low density storage tank, together with a high level alarm, was installed. But what really cracked the problem was the removal of several of the bolts from the hub cover on the back side of the washer, to cut down the vacuum. We now can run on 2, 3, 4, 5, or even 6 hole operation, depending on the speed and type of stock.

The water balance on the brown side gave us a lot of cause for worry. The brown stock washer thickener filtrate feeds three large pumps. One is for the final brown stock washer dilution to the Lindblad; one is for flat screen dilution; and one is for flat screen showers. This filtrate tank kept foaming out of the vent and filled up the driveway. The main overflow went to the deaerating tank which receives all the bleach plant foam. There is a 6-in. fresh water line into this filtrate tank, with a Wizard level control, but no indicator, so the operator could not know what level he had. Several times the tank went dry, giving us really nasty plug-ups around the Lindblads and the washer thickener. The location of the overflow was moved down on the side of the tank and discharged into the sewer behind the deaerating tank. This helped the foam problem a lot when the flat screen showers were put on fresh water the foam problem from the washer thickener filtrate was whipped. An interesting side light on this problem came after the overflow line was installed, when the filter plant ran low on water. We put on another pump but could not figure where all the water went. The new 14-in. overflow was siphoning it out of the filtrate tank as fast as all the make-up, including a 6-in. mill main header, could put it in. A 2-in. vacuum breaking check valve fixed it in a hurry.

Stock flows from the washer thickener onto a belt into the brown high density storage. The high density storage setup usually seems to give a problem or two before it settles down. The problem here requires that we add some water with the pulp in order to get it out fast enough. A booster pump is to be added to the gang and oscillating showers to take care of this. The pulp is then pumped into a low density tank and then into the bottom of the chlorinator tower. There is a piping arrangement whereby this last pump can also empty the chlorination tower. This system gave a lot of trouble until a 3-in. high-pressure water line was run in back of the

pump. We also had to put a flushing connection into the check valve on the discharge side of the pump. Even with these flush lines, this pump still has decided plugging tendencies.

Equipment problems and operational problems are tied up in our experiences with the chlorinator. A chlorination tower, such as the Everett kraft mill has, has two agitators in the bottom and a skimmer at the top to knock the rising pulp off into the collecting trough or launder, which leads it through stainless pipes to the washer vat. After a short time it was noted that the stainless steel skimmer was so badly attacked by the wet chlorine atmosphere that it became necessary to replace it with more sturdy rubber-covered material. We also found a decided foaming and floating tendency in kraft stock which showed up on shutdowns. Shutting down the agitators diminishes these tendencies. Of course, if the shutdown is for more than a few hours, the tower is drained.

As the pulp flowed through the bleaching equipment many small matters kept popping up but until the second (or batch hypo) stage, our troubles were all small and could be corrected by installation of flush-out connections on the stock pumps or valve adjustments on the automatic valves, or similar solutions. In the batch stage the pulp is fed into the individual cells from the distribution belt by means of automatically controlled gates; it is dumped by an automatic dump valve and diluted by an automatic water valve. All these functions are controlled by instruments on the main operating floor and are entirely out of sight of the man in charge. The water valves gave some trouble, which required that a man be on shift to open and shut the hand valves until repairs or replacements could be made. Also, here again the instrument men came in for a lot of adjusting to get the sequence of events exactly right for each cell. Finally they had to change the filing order so that the gates did not have to swing shut through the flow of stock on the belt. They now swing open through the flow, so that the end cell is filled first, and so on. The stock belt, previously mentioned, is interlocked with the no. 2 belt, the stock mixer, the repulper, the washer drive, and the stock pump to the washers. However, if during the filling cycle when only one gate is open and another one fails when the cell is full, all the stock then goes on the floor and backs up on the transfer point. To prevent this, a simple kickout switch at the tail pulley shuts down the whole works. It takes a while to get going again but it is as nothing compared to a big stock plug when no one is there. A few minor piping changes for dilution in the final bleach washer vat and dilution to the bleach liquor lines were made but were not really problems.

As in the brown side, the water balance gave us a lot of headache. Number 6 (or final) footbox vent spewed foam and water to an annoying degree considering it was hooked up to a 16-in. transfer line to no. 5 footbox, and so on down the line to the eventual outfall to the deaerating tank. This system, even more complex than the brown side, took the barometric condenser water from the machine, the wire pit excess, and fresh water make-up. In turn, it fed dilution water to the high density storage and dilution to the bleach stock consistency controller.

The solution of the problem was quite as complicated as the system but one of the major factors was the discovery that the spewing from no. 6 footbox was primarily an air problem. As much of the water from the machine room as could be used there was used. Fresh make-up to the footboxes was virtually shut off, and a special overflow line from no. 6 footbox to the brown stock washer thickener filtrate tank was put in.

All the waste water from the bleach plant flows by gravity from nos. 1 and 2 footboxes to the deaerating tank, entering tangentially about halfway to the top of the tank. The discharge of the tank is controlled by a bubble tube instrument, butterfly valve combination which is designed to hold the level of the liquid above the entrance of the bleach plan effluent. This keeps the foam down by cutting the turbu lence. Much foreign material, common to a mill start-u got into the tank and thence into the butterfly valve, causin trouble with the level. This, in turn, caused foam build-up the level was low, or backing liquor and foam back into th system if the level was high. Several clean-outs of the tan and reworking of the butterfly valve have changed this sy tem into a good operating unit. It is the effluent from th tank, by the way, that is piped under the river to the lagoo This tank also receives, via sump pumps, the drainage fro all the floors in the pulping group and adjacent areas. Sin the gradual reduction of overflows, reuse of the water, an operational smoothness the original sewer pump seems mo nearly adequate than at first, but still it was necessary order and install a second pump.

The machine room has had its fair share of problems. A the start it was found that a slight settling had taken pla under the back side of the wire and presses. The separatio of water and air from the suction boxes and couch roll wa not complete enough to enable the pumps to pull the needed vacuum, so a larger separator had to be installed. Som piping changes and additions in the drainage system of th drier and the condensate pumps and drier vacuum pum water separator were needed and made. The sheet weig control to the machine was very erratic. Stock from the hig density storage is diluted by water controlled by the load o the high density agitator and pumped to the machine chest From the chests it has been pumped through a consisten controller, through the six Lindblad screens, to the consta headbox to the machine. Consideration has been given changing this route, so that the machine will be taking co trolled stock directly from the tanks, thus giving a much la ger volume to even out the highs and lows in the consisten as the stock goes through the screens. We have also ha some cracking and failure of the stainless piping near th Lindblad screens. There seems to be in addition, an a binding condition in the accepted stock line and pump fro these screens which is very annoying but should be mu better with the new routing described above. As it has be if one Lindblad screen fails, the air from that one binds the pump making the level rise and fall alarmingly in th constant headbox. What it does to the sheet weight is rea bad.

The slitting, cutting, and boxing equipment works ver nicely, even to the point of changing from bales to wrappe and returning without breaking down the sheet. This is good stunt and takes a lot of cooperation, but the boys have down pat now and it is a pleasure to see it done.

The highly automatic pulp handling equipment after th layboy, however, has required a heavy attendance from th millwrights and electricians. The operators feel that som of the controlled cycles are too slow and that the operati could be speeded up by making it a little less automat The automatic stacker has had trouble. It has had to ha many shear pins replaced in the drive. Probably the maj source of this trouble is in the electrical sensing and timi setup.

To go back a little, the lineshaft drive on the machi seems very successful. Some of the belts have had to be tigh ened, and some of the belt position shifters have had have little extensions put on them to keep the belt from jum ing out when it gets a little loose. A clutch is to be install on the drive to the cutter so that the machine can be turn over or run while work is being done on the cutter or slitte

We next go to the liquor making department. The cooki liquor was made up from sodium carbonate and sodium s phide dissolved and heated in the dissolving tank and pump right through the system as would be normal green liqu This was a bit laborious but it gave us a good start-up w the use of all the equipment.

It is difficult to discuss any start-up problems in the liqu

rooms or kiln. All tanks, clarifiers, and pumps were checked out with water, as was all the other equipment throughout the mill. The liquor making equipment has performed faithfully to date, with very little attention. One might mention the severe expansion contraction effects in the hot lime conveyor which seem to show up right away, but this must be normal. Also, we have had an annoying time with the formation of balls and rings in the kiln. As our mud soda content is, and has been, very low we are still in the woods on this one. Finally, the white liquor line from the clarifier to the storage at the digesters has gone in a big hurry. Many sections are already replaced with stainless.

Operating technique and problems have reared their heads during the above equipment discussion but some of the items to follow are not concerned with equipment design and can be gone over separately. On the start-up around the digesters we used the hot water from the hot water blows to chase through the brown stock system and flush it out. It also disclosed leaks, loose joints, packing gland trouble, and all such related items to be found. Items such as determining correct rotation of pumps were taken care of by construction but the operators were definitely on hand checking along with construction. This hot water run around also gave us first crack at getting the valves and instrumentation in line. This was, and is, a serious problem and took much time and caused much trouble until each valve and instrument had been truly calibrated, finally in terms of pulp and black liquor.

Calculations very early put us on the right track as to digester charges, both for chips and liquor, although we had some guesswork until the weightometer on the incline belt to the digesters settled down. It soon became apparent how many chip feeders to use and how much to open the feeder slices by the way the belt handled the chips and the length of time to fill.

Operation of the washers is a matter of experience with the individual characteristics of each setup a little different. Here the big problem was to get the right flows of stock, dilution, and showers and this in turn, went right back to the valves and instrumentation.

The screens normally would have worked fine but they had to contend with such wide ranges of rates of flow that it was difficult to evaluate their true performance right at first.

An operating difficulty that assumed importance far above its normal size was a lack of hose fittings and gaskets especially. It certainly can be frustrating to have stock all over the place or a plugged stock line and then have to spend an hour or more sometimes making up a "t'will do" hose connection. It was wonderful when the gaskets finally flew in.

Getting stock out of the grown high density in sufficient quantity became a problem which was solved by a fire hose dumping water in with the stock.

One operating problem that was early discovered is that the gravity line from the top of the chlorinator can plug—and tight. We always flush out all stock lines now.

Chlorine handling is not a big problem, thanks to careful thought in the design and installation but we did plug the chlorine line going to the bottom of the tower. We have air into this line now to blow out the chlorine before the valves at the bottom of the tower are shut off. We found out, also, that chlorine cars do not run indefinitely, nor that they are necessarily empty when chlorine does not come out. A several-hour shutdown, during which we thought we were out of chlorine, taught us this lesson the hard way.

Bleach liquor making went fairly well but to smooth it out an experienced bleach liquor maker from the sulphite mill was asked to come over and get the operators all doing the job the same way. This department has given no trouble.

The technical department did a thorough job of bleaching treatment, following up each operating discovery or improvement with a revised bleaching procedure which early in the game produced top grade pulp. In general, at the start-up brightness was selected as the quality to shoot for. As soon as the brightness specification was met, we worked on the strength till it was satisfactory. All this time we were clearing the system of dirt and soon had pulp up to all specifications.

Frank E. Caskey, Crown Zellerbach Corp.; James d'A. Clark, Consulting Engineer; Kenneth Chapman, Weyerhaeuser Timber Co.; and Raymond B. Seymour, Atlas Mineral Products Co.

This record pays silent tribute to the forethought, ability, and skill that went into the design of the mill. As a matter of fact, however, it would be difficult to single out any one group or department for special praise.

In conclusion, any start-up talk would be incomplete without mention of the added extra hours and work involved. The designers, maintenance men, operators, powerhouse operators—in fact everyone connected with the mill—have put in more than a fair contribution of their own time and effort to make the start-up a success.

Corrosion Problems in the Pulp and Paper Industry

The first commercial plastic was produced about a century ago by the action of nitric acid on cellulose which can be obtained from wood. The father of the plastics industry, John Wesley Hyatt, mixed this nitrocellulose with camphor and christened the product celluloid.

The conversion of wood to billiard balls and celluloid collars amazed our grandparents. It is equally astonishing to learn that the modern paper mill can not operate effectively without plastic materials of construction.

The interdependence of the plastics and paper industries was the basis of a discussion of Raymond B. Seymour, executive vice-president of the Atlas Mineral Products Co., who appeared on the program of the Technical Association of the Pulp and Paper Industry at Everett, Wash., on January 19.

Mr. Seymor's first work in plastics was with cellulose derivatives but he later became interested in developing plastics as materials of construction for the paper industry.

Fifteen years ago, he produced the first plastic cement that could be used to join brick in modern soluble pulp digesters. Prior to that time, the cooking of wood fibers with lime and sulphur presented no unusual problems. An insoluble coating formed which protected the brick-lined digesters.

The more modern pulp cooking process employs caustic instead of lime and since no insoluble coating is formed, the unprotected vessel may be destroyed by acid in a relatively short period of time. The successful furan cements were produced from furfural, a product obtained by heating corn cobs with acid. This type of cement which makes modern papermaking possible, is now produced at a rate of over 10 million lb. annually.

Another plastic produced from chlorine and natural rubber is used as a coating to protect paper mill equipment from corrosion. This coating is also supplemented by a liquid elastic coating based on a synthetic rubber called neoprene. The basic materials used to produce neoprene are lime, coal, and salt.

Other improvements in papermaking technology have required pipe which would not be attacked by acids or alkalies. Plastic pipe which meets paper mill requirements is not extruded from polyvinyl chloride. It is of interest to note that while less than a million dollar's worth of plastic pipe was sold annually in this country 7 years ago, over 30 million dollars worth of plastic pipe was produced last year. Based on its ability to solve problems in the pulp and other chemical process industries, Mr. Seymour predicted an annual production of over a quarter billion dollar's worth of plastic pipe annually by 1960.

For many years, the paper chemist has attempted to produce high quality white paper. However, in many cases the fiber strength was reduced by the bleaching treatment.

More recently a new bleaching agent called chlorine dioxide has been introduced. It will produce strong white paper from the darkest colored pulp stock available. Unfortunately, this chemical attacks stainless steel, rubber, and almost all known materials of construction.

Again, the chemist came to the rescue by developing a vinyl-base resin cement which is not attacked by chlorine dioxide. This product has been used successfully during the past 3 years in paper mills throughout the United States and Canada. Plastic pipes and exhaust systems resistant to chlorine dioxide are also available. Thanks to the joint efforts of the pulp technologists and the plastics chemists, strong white paper is now available in almost unlimited quantities.

Strength Development Through Stock Refining as Influenced by Certain Variables

Frank E. Caskey

Based on a method (1) which uses the laboratory $1^1/_2$-lb. beater as a reference standard, this paper shows the results obtained from a study of some of the variables of stock refining, in both experimental and commercial equipment. The variables considered are: (1) stock consistency; (2) contact pressure; (3) bar-widths; and (4) species of pulpwood.

The optimum bedplate loading on the laboratory $1^1/_2$-lb. beater for developing burst, tensile and tearing resistancy of all pulps tested, was obtained by using a $2^1/_2$-kg. weight on the lever arm during the entire beating cycle. Further evidence was obtained showing that for the development of high burst and tensile it was necessary to use refiners equipped with tackle of approximately $^1/_4$-in., and to operate the refiner at a relatively low power setting. Moreover, in any refiner or beater it is necessary for the equipment to be in the best mechanical condition to expect good strength development. High stretch was obtained by operating the mill beater at the highest consistency possible.

Mill Control of Beating and Refining

James d'A. Clark

This approach is directed primarily to the younger men, and in order that it is not misunderstood, let us first briefly consider the structure of a typical cellulose fiber. For the purpose let us imagine that a coniferous fiber, 3.6 mm. long and 30 by 15 mu in cross section, is viewed through pair of magic spectacles, having a magnification of 25 times. Then 1 mu would appear to be $^1/_{10}$ in. and the fib 30 ft. long 3 in. wide, and $1^1/_2$ in. thick.

Primary Wall

The outside, or primary wall of the fiber would then appe to be about 0.030 in. thick and somewhat like a porous she of transparent plastic, with a fan criss-crossed fibers e bedded in its inner surface but a smooth, slick outer surfa This wall would be quite brittle if on a sulphite fiber and l brittle and tougher if on an alkaline-cooked fiber.

Secondary Wall

The outer layer of the secondary wall, the secondary w being the main body of the fiber, would appear to consist o couple of hard twine windings, each about 0.050 in. in dian ter, wound around the fiber in a close helix or spiral, as binding the rest of the fiber structure together. The in part of the secondary wall would seem to be made of fuz soft twine windings, in about ten or more layers, each la being wound at a steeper pitch, more and more parallel to t axis of the fiber, until the innermost layer is reached whi would be nearly parallel to it.

Tertiary Wall

Inside of this innermost winding, and around the lumen central canal of the fiber, which would appear through c spectacles to have a cross section of about 2 by $^1/_2$ in. the tertiary wall which would seem to be similar to the p mary wall, except that the wall would embody hard tw spiral windings like those forming the outer layer of the s ondary wall.

Beater Bars

On the same scale, if the fibers were in a beater with b $^1/_4$ in. thick they would appear to us to be 53 ft. thick, a even if their leading edges were in reality unusually sha say having a radius of only 0.001 in., the edges neverthe would be rounded with a $2^1/_2$ in. radius, comparable with maximum diameter of the model fiber.

Beating

When the fibers in the wood pulp are caught and rub between the edges and faces of the bars, in view of the pecul construction of the fibers, the results would be somew analogous to feeding and smashing bundles of cigars betwee pair of oppositely moving railroad ties with $^3/_4$ in. radius edges, set to pass each other at about twice the thickness the cigars. Under this action, the cigars would be cut, cut each other, they would be split externally or unrave and rubbed and much of the "wrapper" would be looser and removed and the inner "filler" would be split, separat and bruised. Some cigars would be bent and a lot of toba dust and small pieces would be made.

Similarly when fibers are beaten between a pair of blu metal bars in water and, eliminating metaphysical happ ings, all that can possibly take place is that the fibers will (1) cut (2) split externally, that is, fibrillated and rubb (3) split internally, that is, bruised and (4) curled, twist or bent. It is important to recognize that all these effe happen together during beating; it is quite impossible have pure cutting, pure fibrillation, pure bruising, or p bending. Usually, the curling, bending, and twisting of fibers in ordinary beating is of minor significance and in f ther discussion, this factor will now be disregarded.

Beating Effects

It is equally important to realize that nothing other th cutting, splitting, and bruising happens to the fibers, ap from the fact that as soon as a new crystalline cleavage occ in the body of the fibers by the mechanical action, a layer

James d'A. Clark, Consulting Engineer, Longview, Wash.

water molecules attach themselves to or are absorbed by the newly formed surfaces and these attract other layers of water molecules, all of which, is a fancy way of saying that the new faces become wetted with water. It will be understood that we have assumed that the fibers have been soaked in water before beating so that all the noncrystalline surfaces, which are the amorphous or spongy regions in the body of a fiber, will already have been wetted.

Of course, when wider splits or new crevices are formed in the fibers, they will absorb more water, but this is a trivial matter since then the fiber is behaving merely as a sponge, and the extra water entering these crevices will just as readily flow out again if the fibers are gently squeezed.

Beating Control

Since it is impossible to beat fibers and not do some cutting, some splitting, and some bruising, and by these three simple happenings effect a number of secondary physical changes, it is clear that with a given beater or refiner in a given condition and at a given setting, we should be able to control the progress of beating a given stock by measuring any one of the main or secondary changes.

The following is a list of the more applicable currently available tests for the changes caused by beating, together with notes on their characteristics:

1. *Cutting.* Classifier—high speed, single, or multiple screen type. Percentage of long fibers retained by coarse screen is decreased slightly by increased wet flexibility of the fibers. Reproducibility; excellent. Sensitivity; good. Interpretation; superior. Manipulation, simple. Time, 2 min. working plus 10 min. waiting. Long fibered fraction decreases approximately in proportion to the amount of beating.

2. *Splitting.* Silvering and peroxide technique (see TAPPI T 226-sm). Test unaffected by cutting or bruising except by the concomitant production of debris. Reproducibility, good. Sensitivity, good. Interpretation, good. Manipulation, difficult and delicate. Time 10 plus 10 min. Specific increases approximately proportionate to the amount of beating.

3. *Bruising.* Density of TAPPI Standard test sheets. Test is unaffected by cutting but is affected somewhat by splitting. Reproducibility, excellent. Sensitivity, poor. Interpretation, excellent (is a very good measurement of the true wetness or running quality of the stock). Manipulation, care needed. Time 10 plus at least 120 min. Density increases in exact proportion to the logarithm of the amount of beating.

(a) Shrinkage: Make sheet, dry in oven, measure shrinkage after drying. Test affected appreciably by splitting, slightly by cutting. Reproducibility, good. Sensitivity, good, better for well-beaten stock. Interpretation, good. Manipulation, fairly simple. Time 2 plus 10 min. (only 1 min. extra if classification test is also made). Shrinkage gives slightly S-shaped curve rising in proportion to logarithm of amount of beating.

(b) Burst: May be made on dry hot sheet for the shrinkage test after its completion. Affected by cutting, splitting, and bruising. Reproducibility, good. Sensitivity, very good. Interpretation, good. Manipulation, fairly simple. Time, 4 plus 10 min. ($^1/_2$ min. extra if shrinkage test is also made). Burst increases in proportion to logarithm of the amount of beating.

(c) Drainage Time (for Slow Pulp), Drainage Factor (for Free Pulp): Time for a test sheet or a pad to drain in the TAPPI sheet machine (see TAPPI Standard T 221-m). Test greatly affected by debris and substantially by bruising and splitting. Is not affected by cutting. Reproducibility, excellent. Sensitivity, excellent. Interpretation, fair. Manipulation, simple. Time, 2 plus 10 min. (only $^1/_2$ min. extra if classification test is also made). Results increases with beating, faster as beating proceeds.

Panel: Frank E. Caskey, Crown Zellerbach Corp.; Loren Forman, Scott Paper Co., (Moderator); E. H. Nunn, Crown Zellerbach Corp.; James d'A. Clark, Longview, Wash.; Kenneth Chapman, Weyerhaeuser Timber Co.; and Raymond B. Seymour, Atlas Mineral Products Co.

(d) Freeness, Schopper-Riegler or Canadian Standard: Test is almost entirely affected by the quantity of debris present, is unaffected by cutting, and only slightly by splitting and bruising. Reproducibility, excellent (unless the drainage cone is cleaned—as with soap and water). Sensitivity, very good for moderately beaten stock. Interpretation, poor. Manipulation, fairly simple. Time, 2 plus 10 min. Freeness decreases slowly with beating, faster as beating proceeds, then may rise.

DIVIDED FUNNEL FREENESS TESTERS

Everyone who is presently using a freeness tester, owes it to himself and his employer, to make at least these three simple experiments and then proceed to harmonize and reconcile his findings with his own theories and with the literature, including the most recent.

Experiment 1. Measure the freeness of the stock from the headbox (or the machine chest) of a machine just starting up with fresh water in the system, and again when the white water system is in operation. The latter freeness will be considerably lower. *Question:* Has the speed of the paper machine then to be reduced because the stock tests much slower? *Answer:* No, on the contrary the machine will usually be running faster.

Experiment 2. Measure the freeness of the stock for a high-grade bond or a greaseproof machine going as fast as it can remove water (perhaps a couple of hundred feet per minute) and also on a newsprint machine making the same weight of paper and removing water as fast as it can (at about 2000 f.p.m.). *Question:* Does the newsprint stock accordingly test much freer than the greaseproof stock? *Answer:* No, on the contrary the freeness test of the news stock is much lower.

Experiment 3. Obtain some pulp that has been well beaten in the laboratory or mill until it is well "hydrated." Determine its freeness and make a test sheet and test this for burst. Take another portion of the same beaten stock, place in a 200 or 150-mesh laboratory screen, and wash it well with a stream of water. Determine the freeness and the bursting strength of a test sheet made from the washed stock. If sufficiently washed the freeness will be found to have returned almost to its original unbeaten value, whereas the burst of the test sheet (and most other qualities except to a lesser degree its air permeability) will be found to have been diminished by only a small factor of 5 or 10%, from those made on the unwashed stock. *Question:* Where has the "hydration" (as measured by the freeness tester) gone? *Answer:* Down the drain with the debris.

The converse experiment may be performed by measuring the freeness and burst of any stock, using fresh water. Repeat the measurements using white water. The use of the white water will prove to have an overwhelming influence

on the freeness test by an insignificant one on the strength of the test sheets, and, as we have already described, no appreciable influence on the wetness or running quality of the stock on the paper machine.

DRAWBACKS TO THE FREENESS TEST

Because cutting, splitting, and the making of debris must occur simultaneously in various degrees during any beating or refining operation, a measure of any one of them must necessarily give a valid measure of the progress of the beating *if*, and this is a big *if*, all other things are equal. Since freeness measurement can be so profoundly influenced by the addition of a little extra debris contributed by extra white water or perhaps produced locally by a streak or band of intense bar contact around the uneven rotor of a beater or refiner, it is a very frail reed on which to lean when things change or go wrong. That is just the time, of course, when reliance on control measurements should be complete. On the other hand, the addition of a little extra debris by way of the white water or uneven beating tackle has very little influence on the other easy-to-make tests like the measurement of the percentage of long fibers as described, and since with beating, this also changes equally well, and more so with relatively raw stock, the classifier makes an infinitely more reliable, and thus preferable control test instrument to the freeness tester.

Suggested Method. Ideally, if only a little extra time can be afforded for control (and what is worth doing is usually worth doing well) the following is a possible scheme that may be adapted to most beating or refining operations and which will afford the most information in a minimum of time.

Take approximately a 10-gram sample of beaten stock. Dilute to 2000 ml., pour out about 1000 ml. into a cylinder and record the exact volume, pour into the first chamber of a high-speed classifier and classify ($1^1/_2$ min.). Again pour into a cylinder a chosen quantity of from approximately 250 to 1000 ml. (the volume chosen depending on whether the stock is well beaten or not), record the exact volume and pour into a TAPPI Standard sheet machine. Dilute to the mark, stir, and while waiting 10 sec. take its temperature (from a thermometer permanently tied to the stirrer) then open the drain valve and time the outflow until the sheet becomes "dry," or the air hisses through it. Couch the sheet and press the wet sheet with couch blotter attached, between a chosen number of dry blotters, with a weight, for a few seconds. Remove the test sheet from the couch blotter and mark it with a template with two or preferably four points in a square spaced exactly 5 in. apart, after touching the points with moistened indelible pencil. Place the sheet in a drying oven kept at 120 to 130°C., preferably one having a fan to circulate the air, and from the classifier obtain and add to the oven the pad of long fibers. Weigh the sheet and pad as soon as they are dry, measure the average distance between the imprinted points, burst the sheet in two or three places and preferably, using nomographs, calculate the following four characteristics from the observed data:

1. Percentage of long fibers (ratio of pad to sheet weight).
2. Drainage time (or factor) corrected for temperature and the weight of the sheet in accordance with TAPPI Standard T 221-m.
3. Percentage of shrinkage of sheet during drying.
4. Burst factor of dry sheet (corrected for sheet weight in accordance with TAPPI Standard T 220-m).

With a little organization, these four tests may be made concurrently in less than 15 min. time (versus about 12 min. for the freeness test alone). They will provide reliable understandable information about the stock and the manner in which it has been beaten and will most advantageously replace the illusory measurement of that popular, abstract, imponderable attribute of beaten stock called "hydration."

Ohio

One hundred and forty-seven members and guests were attendance at the Jan. 12, 1954, meeting of the Ohio Secti of TAPPI at the American Legion Hall in Middletown, Oh Chairman John Clouse presided over a short business meeti preceding the program of the evening. Minutes of the p vious meeting were read. The February 11 meeting, h at the Manchester Hotel, Middletown, was announced program Chairman Bill Aiken. W. C. Huebner talked "Printing—Past, Present, and Future."

John L. Clouse, Oxford Miami Paper Co.; William Aiken, Gardner Board & Carton Co.; Brainard (Ted) Sooy, Gardner Board & Carton Co.; and Adolph Bedna Interstate Folding Box Co.

Adolph Bednarz of Interstate Folding Box Co., Miam burg, introduced the speaker of the evening, B. E. Sooy Gardner Board and Carton Co., who spoke to the grou "Statistical Quality Control."

Following the talk of the evening, a sound movie in colo "The Complete Job of Making a Fourdrinier Wire"—w shown by Frank Halloin of Wisconsin Wire Works, Applet Wis.

Mr. Sooy, after a few introductory remarks and illustrati of statistical quality control in practice, enumerated m materials, machines, and management as the basic variab

Group at the January meeting of the Ohio Section

George B. Gregg, Cincinnati Gas & Electric Co.; Richard Grimm, Stein Hall Co.; John F. Nolan, Sorg Paper Co.; Harold R. Joiner, Champion Paper & Fibre Co.; John L. Clouse, Oxford Miami Paper Co.; Brainard (Ted) E. Sooy, Gardner Board & Carton Co.; Adolph Bednarz, Interstate Folding Box Co.; William H. Aiken, Gardner Board & Carton Co.; Russell L. Clark, Mead Corp.; and Frank Halloin, Wisconsin Wire Works

which determine quality. Of these, men and management were selected as having the greatest effect on quality of paper and board manufacture. Statistical quality control is a very important management tool and is capable of effecting major gains with operating personnel. This is especially true if the S.Q.C. approach is approximately 90% psychological and 10% scientific.

The objectives of statistical quality control are: (1) to make production of quality as easy as possible, (2) to provide incentive for people to do a good job, (3) to provide management with good operating facts and (4) to protect the customer's interest in the plant. Certain basic requirements must be met in order to successfully accomplish the objectives of S.Q.C. First and foremost, the quality control approach with production personnel must be a friendly one and not one of monitoring. Statisitical quality control charts are to be considered as a pair of eyes for the operating personnel. Secondly, S.Q.C. should deliver news and not history. This practice permits adjustment in operations when it will be meaningful. Another basic requirement of S.Q.C. is the delivery of facts and not opinions. Such data provide a sound basis for specifications.

Statistical quality control in practice teaches people to think in terms of variability. The returns from such a program can be expected to be found in improved quality, lower spoilage, costing, improved morale, reduced complaints, improved industrial relations, improved customer relations, and improved sales position. However, the note of warning with respect to statistical quality control application was: don't go overboard; don't get high-brow. Successful statistical quality control is realized in 90% psychological and 10% scientific application.

Quoting from the Bolton Award papers of 1953, the "Obligations of a Company to Its Employees," included job security, personal recognition, quality of management, advancement, good communications, job training, etc. S.Q.C. functioning properly contributes in some part to each of these obligations.

Statistical quality control charts and data were available for study and discussion at the end of the meeting. A considerable interest in S.Q.C. methods and techniques was manifested in this past meeting discussion.

RUSSELL L. CLARK

Chicago

Allergic reactions to materials entering the manufacture of food containers was the subject of a talk presented by T. G. Randolph to the Chicago Section of the Technical Association of the Pulp and Paper Industry, January 18. E. C. Berg of the Ace Carton Corp., Chicago Section Chairman, presided at the meeting which was held at the Chicago Bar Association.

C. I. Macnair, Acme Steel Co.; E. C. Berg, Ace Carton Corp.; T. G. Randolph; James D. Johnson, Container Corp. of America; and Charles H. Krebs, Atlas Boxmakers, Inc.

Mr. Randolph, a specialist in allergies, was formerly in in charge of the Allergy Clinic at the University of Michigan, and has for the past 10 years conducted a private practice in the Chicago area. He has co-authored a book on food allergies, and written a number of technical papers on the subject.

The talk was accompanied by slides which detailed reaction of various cartons and containers to the iodine test for starch. A question and answer session followed, with Charles Krebs, Atlas-Boxmakers, Inc., program chairman, in charge. C. I. Macnair of Acme Steel Co. introduced the speaker.

Lake States

The third meeting of the Lake States Section of TAPPI was held at the Hotel Conway in Appleton, Wis., on Jan. 12, 1954 with an attendance of 190. Reine Vogt of the Combined Locks Paper Co. acted as moderator for a panel program on the subject of "refining." The panel was made up of the following members: W. R. Haselton, Rhinelander Paper Co., D. J. MacLaurin, The Institute of Paper Chemistry; F. X. Kreiling, Thillmany Pulp and Paper Co.; Ray Nilsen, Northwest Paper Co.; and H. P. Dixson, Fox River Paper Corp.

An introductory talk was made by Mr. MacLaurin in which he discussed the objective and theories of refining. Following this the other four panel members gave talks on refining in relation to the manufacture of the following types of paper: glassine, sulphite bond, kraft specialties, and rag bond.

There was fairly complete agreement by the speakers that all types of conical refiners are very similar in performance. The statement was made that advantages that refiners such as the Morden Stockmaker may have are largely due to the use of a pump to force stock through the refiner thereby limiting the work done by the refiner to work done on the fibers. A consistency of 3% was generally agreed on as being proper for conical refiners.

Some of the men at the speaker's table at the Michigan Papermakers Get-Together included: Leon H. Mimms, Kalamazoo Paper Co.; Leonard A. Pierce, St. Regis Paper Co.; George Olmsted, S. D. Warren Paper Co. (speaker); and Reginald H. Hurst, Kalamazoo Vegetable Parchment Co.

The possible use of variable speed motors for conical refiners was stressed by one speaker as a means of securing greater flexibility in refining. The best filling for a jordan, for rag refining at least, was stated to be a hard plug filling, preferably stainless steel and a soft shell filling.

The use of fractionation tests to control the degree of refining of rag stock was mentioned. The fractions retained on the 20-mesh and passing the 150-mesh screen were said to be the most important.

Concerning the manufacture of glassine it was stated that beating times of 12 to 15 hr. were formerly used. The use of multi-bed plate heaters and instrumentation has made possible beating cycles of 3 to 4 hr. Continuous refining systems using conical refiners have augmented and replaced batch beaters. It was stated that the energy consumption was about the same with either beater or conical refiners. The energy expended in refining amounts to from 600 to 1000 hp.-hr. per air-dry ton of stock to reduce the freeness to below 100 Canadian Standard.

In summarizing the discussions Mr. Vogt stated that purposes of refining were: (1) improve formation on the paper machine, and (2) adapt fibers in a better manner for specific paper properties. These purposes are accomplished by cutting, bruising, and separation of fibers. It is possible to use a variety of equipment to accomplish these effects.

S. R. Parsons, *Secretary*

Harry E. Weston, Secretary and Treasurer, The American Pulp and Paper Mill Superintendents' Association; Frank Roberts, S. D. Warren Co.; Olin W. Callighan, Edgar Brothers Co.; Marshall H. Rutz, Kalamazoo Vegetable Parchment Co.; Claude Bos, St. Regis Paper Co.; Harrison Kindig, Mac-Sim-Bar Paper Co.

Kalamazoo Valley

The 19th Annual Kalamazoo Valley Papermakers' G Together, a joint meeting of the American Pulp and Pap Mill Superintendents Association and the Kalamazoo Vall Section of TAPPI, was held at Hotel Harris on Jan. 1954.

George Olmsted, Jr., president of the S. D. Warren C Boston, Mass., the feature speaker, gave an address "The Task Ahead." He told of the trend paper indust leaders and technicians must follow if they are to contin their progress of the last 30 years. First, he declared, th must hammer down costs. Secondly, they must create n products for new customers in new fields. Third, they mu select the right technical men and enough of them to keep t paper industry growing.

Mr. Olmsted stressed the need to use technical methods lower the cost of manufacture, to develop new products and a plication, and to use aggressive merchandising. Outstandi opportunities lie in substitution of paper for other materia he declared. Among these fields, particularly, the speak cited metal, cloth, acetate film, and cans. He also said th the paper business is becoming more and more a chemi operation and less and less mechanical.

Leonard A. Pierce, manager, St. Regis Paper Co., Ka mazoo, as toastmaster, introduced Mr. Olmsted and varic other industry leaders at the speakers' table. These include Frank Roberts, S. D. Warren Co.; Olin Callighan, Edg Brothers Co.; Marshall H. Rutz, Kalamazoo Vegetal Parchment Co.; Claude Bos, St. Regis Paper Co.; Harris Kindig, Mac-Sim-Bar Paper Co.; Leon H. Mimms, Kalan zoo Paper Co.; Ray Barton, Michigan Paper Co.; Willia Hathaway, Kalamazoo Vegetable Parchment Co.; Robert Elias, Western Michigan College; J. Arthur Dean, Michig Paper Co.; Harry E. Weston, Secretary and Treasurer of t American Pulp and Paper Mill Superintendents Associati R. G. Macdonald, Secretary-Treasurer of the Technical A sociation of the Pulp and Paper Industry; Reginald Hurst, Kalamazoo Vegetable Parchment Co.; and Richa T. Trelfa, Watervliet Paper Co.

The meeting was attended by more than 400 members a guests.

February Meeting

The February meeting of the Kalamazoo Valley Section TAPPI was held at the Hotel Harris, Kalamazoo, with Cha man R. H. Hurst presiding. Chairman Hurst announced t March meeting would be a graphic arts session in cooperati

J. A. Dean, Michigan Paper Co.; Richard T. Trelfa, Wat vliet Paper Co.; Robert T. Elias, Western Michigan C lege; William Hathaway, Kalamazoo Vegetable Parc ment Co.; and Raymond L. Barton, Michigan Pap Co.

R. T. Elias, Western Michigan College; R. H. Hurst, Kalamazoo Vegetable Parchment Co.; J. C. Barthel, speaker; J. A. Dean, Michigan Paper Co.; and R. T. Trelfa, Watervliet Paper Co.

with the Michigan Division of the American Pulp and Paper Mills Superintendents Association. Paul J. Thoma, Time, Inc., is the scheduled speaker and the meeting will be held at the Hotel Harris, Thursday, March 4, 1954.

Mr. Hurst then turned the meeting over to J. A. Dean, program chairman, who introduced the speaker of the evening, J. C. Barthel, assistant technical director, Paper Chemical Department, American Cyanamid Co. Mr. Barthel presented a talk on sizing neutral and alkaline papers. A summary of the talk follows.

Conventional materials used to size paper include such products as rosin, asphalt, and wax sizes. All are used in conjunction with aluminum sulphate for beater sizing although they may be used by themselves for surface application.

The necessity for aluminum sulphate has largely limited the manufacture of sized papers to acidic grades. Attempts to size alkaline papers, particularly calcium carbonate filled papers with modified sizes, are cited in the patent literature, but little success has been realized in their practical use.

American Cyanamid has developed a new, thermoplastic, water-dispersible, synthetic wax size sold commercially as Cyron size. Chemically, it is a salt of a hydrophobic polyfunctional amine and is cationic in nature. Cyron is readily dispersible in water and may be used either as a beater size or surface size.

As a beater size, Cyron is effective over the pH range of 4 to 11. It is most effective when the pH at time of size addition is below 8.5. Cyron should preferably be added after refining of the stock. Cyron may be added to stock at temperatures up to 130°F., and is relatively resistant to the action of most anions.

When both rosin size and alum are present, the efficiency of Cyron is not impaired unless the sheet is formed under alkaline conditions. In the absence of alum, rosin size is detrimental. It is indicated that neither rosin size nor alum contribute to the effectiveness of Cyron and in fact may be harmful.

Cyron may be applied to paper by itself or in conjunction with starch or glue in size press or calender stack to sized or unsized paper. Some converted starches are not compatible and checks should be made before full-scale runs are attempted.

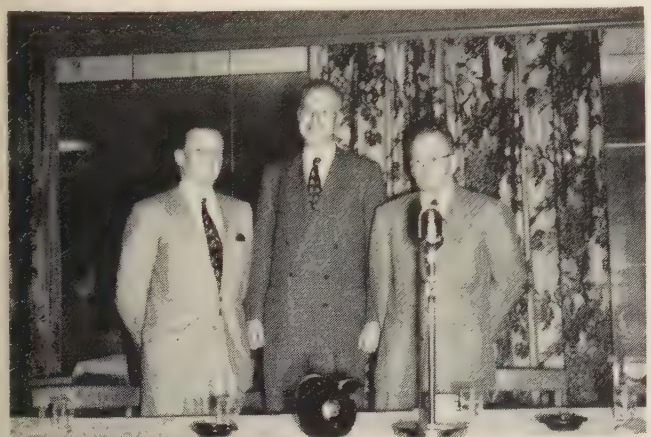
Cyron sized papers are much different from rosin sized paper. The contact angle is much lower for Cyron sized paper, yet the internal penetration of liquid is generally much less. Cyron sized sheets are resistant to penetration by alkaline solutions, including diluted solutions of caustic soda. Furthermore, the sheets may be exposed to water or alkaline liquids, redried, and still exhibit good sizing.

Cyron has a slight weakening effect on paper, its extent dependent on the type of fiber used and the amount of size employed. The use of cooked starch or other dry strength additives has proved effective in minimizing strength losses.

Cyron sized paper exhibits much less color degradation on exposure to ultraviolet than does rosin sized paper.

Cyron has found application to date in a wide variety of papers, including noncorrosive wadding, napkins, coating rawstock, specialty bags, hanging, carbonate filled text, specialty board, labels, and alkali resistant papers.

R. T. Trelfa, *Secretary*



J. C. Barthel, American Cyanamid Co.; J. A. Dean, Michigan Paper Co.; and R. H. Hurst, Kalamazoo Vegetable Parchment Co.

Empire State (Central District)

The January 9 meeting of the Central District, Empire State Section of TAPPI was held at the University Club, Syracuse, N. Y., with 94 in attendance.

Harry Gray, chairman, introduced the members at the head table: W. J. Trimble, acting manager, Syracuse Division of Robert Gair Co., H. D. Cook, Ernest Reed, Syracuse University, S. E. Church, Al Ahlers, manager of the Fulton plant, Mengel Co., and R. G. Hitchings.

"Doc" Cook introduced A. W. Hoffman, quality control manager, Container Division of the Robert Gair Co., who spoke on "The Relation of Quality Control to Paperboard Sales." Mr. Hoffman had previously had 18 years' experience with the Container Testing Laboratories as technical director where he consulted on the design and testing of paperboard containers. He spoke extemporaneously and had no written text.

S. Earll Church, *Secretary*

Empire State (Northern District)

W. Gallay, research director, E. B. Eddy Co., Hull, Que., spoke to the January meeting of the Northern District, Empire State Section of TAPPI, on the interesting subject, "The Research Department Looks at the Paper Machine." This meeting produced one of the largest attendances of the year in spite of the very cold weather and snow.

Mr. Gallay explained that the papermaker, in effect, is putting a disassembled tree together—in a different form, of course, when he produces paper. He said that, "We actually do not know what we are trying to do when we refine." And this is the crux of our problem.

There are three schools of thought on what we are trying to do. The first school of thought favors the mashing of the fiber to produce frayed ends—commonly called fibrillation. The second school believes in destroying the outer wrapping on the fiber to expose the interior of the fiber so as to cause the

S. J. Young, National Paper Products Co.; Wilfred Gallay, The E. B. Eddy Co.; R. J. Murtaugh and J. D. Parmele, St. Regis Paper Co.; and J. H. Treadwell, Treadwell Supply Co.

individual fibers to be able to stick together. The third school wants to get more water into the fiber—to swell the fiber—to make it more elastic.

Mr. Gallay likes to consider refining as a combination of the second and third school of thought with emphasis on the third.

Mr. Gallay asked the question, "What happens to the tensile test characteristic in the range of solids from 0 to 20%?" The 20% solids compare to the web of paper at the suction couch on the paper machine. He then showed us by means of graphs that the tensile value increases from a minimum at a very low solids to a leveling off area at about 20% solids after which the curve continues to rise. Mr. Gallay's laboratory has been able to measure the tensile value at a solids content of 8%. The leveling off section for kraft is longer than it is for sulphite and the groundwood plateau is the longest of the three.

Mr. Gallay thinks that the bonding of fibers does not exist below about 20% solids which he says accounts for the lack of strength of the wet web with a solids content of 20% or less.

In Mr. Gallay's mind we are making a big mistake when we do not put more consideration on learning more about the third dimension—"thickness"—of paper. At present, our knowledge of this third dimension is of a low degree.

RICHARD J. MURTAUGH, *Secretary*

Empire State (Eastern District)

Eighty representatives of mill operating and equipment sales organizations attended the January meeting of the Eastern District of the Empire State Section of TAPPI Thursday evening, January 21.

The meeting was conducted at Milfranks Restaurant under the chairmanship of John W. Crocker, chief engineer of the Sandy Hill Iron & Brass Works in Hudson Falls.

The principal speaker was E. L. Rastatter, technical director, Bauer Bros. Co., Springfield, Ohio, who spoke on the principles and application of vortex cleaners. Certain aspects of the process are among the newest developments in the treatment of cellulose fibers for all purposes.

Grant Cole of the Diamond Match Co. in Plattsburg and vice-chairman of the pulp evaluation method committee, reported on the work of the committee. His complete report will be presented at the March meeting.

H. E. Johnson of the Stevens and Thompson Co., Greenwich, and chairman of the Empire State Section award committee, reported that all executives of paper manufacturing companies had been given copies of the rules. He appealed again for their encouragement of entries from junior memb of their organizations.

Talmadge Edman of the International Paper Co., Palm announced that the next meeting would be held on Febru 28 at LaCabanna, Glen Lake. The subject will be p bleaching.

ALLEN A. LOWE, *Publicity Chairma*

Empire State (Metropolitan District)

About 60 members and guests were present at the Jan. 1954, meeting of the Metropolitan District, Empire St Section of TAPPI, held at Fraunces Tavern in New Y City.

Harris O. Ware of the Hercules Powder Co. spoke on "So Aspects of the Application of Carboxymethylcellulose Paperboard for Improved Gloss Ink Printing."

The application of carboxymethylcellulose to paperbo has produced striking effects in gloss ink printing, and t subject was treated in some detail both from a theoreti point of view and the mill practice together with typical sults obtained. A brief review of the literature demonstra the significance of hydrogen bonding, the uniqueness of po meric molecules, and reactions dependent upon the geome of the cellulose molecule. Carboxymethylcellulose was fined, and the various types available for application to pap board discussed. Data obtained by treating white-lined fo ing boxboard were shown graphically by plotting ink requi ment to achieve a given gloss versus pounds of carboxyme ylcellulose applied to the paperboard. Gloss ink savings high as 40% were shown to be possible by the calender plication of as little as a pound of carboxymethylcellulose ton of board. The effectiveness of such a small amount material was attributed to the combined effects of calen stack pressure and the fiber bonding capacity of the cellu derivative.

Mr. Ware illustrated his talk with a number of diagrams graphs. A very interesting discussion period followed talk.

L. E. GEORGEVITS, *Publicity Chairma*

Empire State (Western District)

E. P. McGinn was the speaker at the Dec. 2, 1953, meet of the Western District of the Empire State Section wh was held in Niagara Falls, N. Y. Mr. McGinn's talk follow

Efficient Use of Dyes in Paper

E. P. McGinn

ALTHOUGH there are many characteristics of pa both physical and chemical, that are important to satisfy dividual use requirements for various grades, appearance important to practically all grades. Of all the elements t contribute to appearance, one of the most important is co At this point it might be well to differentiate between the t uses of the word color. The true meaning of the word is sensation produced on our eyes by light of given wavelen intensity, and brilliance. The word is now also used a synonym for dyes. In this discussion it is used both ways we have tried to make its meaning obvious.

METHODS OF COLORING

There are five general methods of coloring paper as follo (1) beater or mass dyeing, (2) calender coloring, (3) dippi (4) coating, and (5) printing.

Naturally the term beater dyeing includes coloring done

E. P. MCGINN, Technical Director, Sandoz Chemical Works, Inc., York, N. Y.

pulpers or mixing chests. Beater dyeing is by far the most important to the papermaker and will be discussed first.

Problems in Coloring

In addition to dyes or pigments, there are many other items that help to produce the final color of beater dyed paper. These include, color, brightness, and proportions of various pulps and fillers; color and amount of size and alum; degree of beating and pH of stock; condition of water, number of vacuum boxes and presses; paper machine speed; drier temperatures; number of calender nips and pressures; type of finish (wet or dry). Of course some of these variables cancel out but many are additive and will affect the amounts of dye required, or change the final color of the paper.

Fortunately for a given grade and weight, many of the above variables remain fairly constant. However, some of them must be changed to obtain different weights or finishes and then it is up to the color man to correct for this change by adjusting his color formula.

It is extremely desirable to eliminate as many of the above variables as possible in order to obtain the highest degree of uniformity from reel to reel throughout the run. However, in practical operation at most mills, it is impossible to achieve this condition and therefore it is necessary for the color man to acquire a considerable degree of skill in correcting for these variables by matching each batch of stock in the wet state and by constantly checking the stocks in the chests.

CLASSES OF COLORS

Problems encountered in the beater dyeing of paper vary not only with the grade of paper being made, but also with the class of color being used. Each of the various classes: basic, acid, direct, pigment, presents its own particular problems in use. In addition, there are problems which overlap various classes or have no relation to classification.

Basic Dyes

Basic dyes, in general, are very bright; have high color value per dollar, but have poor light fastness. They have good affinity for unbleached pulps and clay, but have poor affinity for fully bleached pulps. Thus, most basic colors may be used with unbleached pulps to produce papers with good side uniformity and with practically no bleeding on the wire. However, these same dyes, when used with fully bleached pulps, may bleed considerably and produce papers which are two-sided.

Chemically, basic dyes consist of positively charged organic color groups solubilized with acid, usually hydrochloric. The color groups will combine chemically with acid radicals or other negatively charged groups. These colors are not resistant to chemicals, especially alkalies.

Acid and Direct Dyes

Acid and direct dyes are similar to each other chemically being sodium or other soluble alkali salts of organic color groups. The color group has a negative charge and will combine with metallic ions or other positively charged ions. Thus positive basic color groups react with negative acid or direct color groups to form insoluble color lakes. The color lakes have much less coloring power than the soluble dyes and act like pigments. These lakes may precipitate in large particles and cause color spots. Thus, great care must be used when basic colors are combined with acid or direct dyes in the same formula.

As previously stated, acid and direct colors are chemically similar, with no sharp dividing line between them, the principal differences being in their solubility and affinity for cellulose. Typical acid colors have good solubility, fair to poor affinity for cellulose and thus can only be used in sized papers. They lie between basic and direct dyes in both brilliance and light fastness. Papers made with typical acid dyes are usu-

E. P. McGinn, Sandoz Chemical Works and Gordon K. Storin, Niagara Alkali Co.

ally two-sided and have poor water fastness. However, there are some notable exceptions to these characteristics. Croceine Scarlet FL (C.I. Pr 148) and the Alizarine Blues (C.I. 1054) are very bright and have excellent light fastness. Papers made with these dyes have excellent side uniformity. Acid colors in general have good solubility and never produce granite fibers, therefore they are very useful for "doping" stock in chests or beaters.

Typical direct dyes have good to excellent affinity for cellulose and may be used in either sized or unsized papers. In general, they are duller and have better light fastness than acid or basic colors. They bleed very little on the wire and have only fair solubility. Unless handled properly, they may produce granite fibers, especially in light or medium shades.

Pigments

Pigments are finely divided solids, insoluble in water. They may be white or colored but only the colored products are considered at this time. They may be roughly divided into two general classes, organic and inorganic. The latter include iron oxides, chrome yellows and oranges, Ultramarine, Prussian Blue, etc. Most of the organic pigments consist of complex organic color bodies precipitated by metallic salts or other organic groups to form insoluble color lakes.

Compared to soluble dyes, pigments are weaker and faster to light. They cover a complete range of hues and a wide range of brightness. They are chemically inert and produce papers which are usually two-sided.

Probably the most important reason for using pigments in beater dyeing is to obtain light fastness. Some of the inorganic pigments such as red oxide, Ultramarine Blue, and Prussian Blue are considered permanent to light. In general, the organic pigments are not as fast to light as the inorganics, but some are very good.

Until a few years ago, the use of pigments for beater dyeing had been steadily decreasing. The reasons for this decline were (1) difficulty in maintaining color uniformity. This disadvantage of pigments has been made worse by speeding of paper machine and decrease in beating, brought about by greater use of jordans and refiners in place of beaters. (2) Cost—in general most soluble dyes give more color value per dollar than pigments. (3) Pigment colored papers are invariably two-sided. (4) Soluble dyes which provide sufficient light fastness for most uses have become available. (5) Waste reclamation—broke from pigment colored paper cannot be stripped, whereas broke from almost all papers colored with soluble colors can be stripped.

However, the development of new products from twisted paper, such as rugs; automobile seat covers and floor mats; fiber-mesh fruit, vegetable, and laundry bags, etc. has created

a new demand for pigments. Some of these twisting papers, such as those used for fiber rugs, require up to 400-hr. fadeometer tests.

ORDER OF ADDITION

The order of addition of dyes and chemicals may be very important, although there are times when it does not matter. Generally speaking, best results are obtained by adding the dyes first, that is, after the pulp and filler if any, but before the size and alum. However, when basic dyes are used with acid or direct colors, it is often desirable to add the direct or acid colors first and then add the basic colors after the size and alum. This avoids the danger of forming lakes with consequent loss of color or other difficulties as previously described.

Basic dyes are weakened by alkali and therefore when added first must be allowed to mix with the stock thoroughly before rosin size is added. The latter should be diluted as much as possible to minimize the concentration of alkali in contact with the basic dye. To avoid weakening of the basic dyes by alkali, as well as to assist in making good solutions, it may be desirable to dissolve them in acetic acid before adding to the stock. This also eliminates any possibility of color spots. Up to 2 lb. of 28% acetic acid for each pound of basic dye may be used.

Even when not used in conjunction with acid or direct dyes, it is sometimes desirable to add the basic dyes after the size and alum to avoid the effect of alkali in the size.

Another color that is weakened by alkali and therefore should be handled carefully, to avoid loss, is Soluble Prussian Blue or chemically–potassium ferric ferrocyanide. This color is classed as soluble mineral. It has no affinity for cellulose but is held in the stock as a pigment after being precipitated by alum. Although the alkali in rosin size will partially destroy this color, the effect can be avoided by allowing the color to mix thoroughly with the pulp before adding the size. The latter should then be added as dilute as possible and well distributed.

Most direct colors have a tendency to produce granite fibers, also called feathers, color tails, or mottling. The danger of graniting is much greater with mixed furnishes, especially those containing unbleached or semibleached pulps. The trouble can be avoided by adding the direct colors in cold dilute solutions or mixing with a few gallons of clay slurry. In some mills the dyes are added to water in the beater before most of the pulp is furnished. The direct colors may also be added to hardwood pulps with less danger, since only deeply colored, long fibers show up as graniting. However, it is possible to produce uneven coloring or mottling with hardwood pulps and while not as apparent as granite fibers it is usually undesirable.

In many mills direct colors are furnished to the beater dry, and often in large quantities, without ever being troubled by granite fibers. The precautions recommended above to prevent graniting usually require extra work and therefore it may be desirable to use them only if necessary. The color supervisor in each mill must learn how far he can go in cutting corners without getting into trouble. As mentioned above, there are mills where most of the colors are added dry without ever having trouble due to color spots or graniting, and yet in other mills making the same grades, the color men have learned by experience that many dyes must be dissolved and strained to avoid color spots. Obviously since there is such a wide variation in results from mill to mill, dyestuff manufacturers can only recommend the safest procedure, that is, that all dyes be dissolved and strained and that direct dyes be added in cold dilute solutions.

Pigments are normally added dry to the beater, but some are added as pastes or pulps. Dispersed pigments, such as the phosphotungstate lakes, may be used as liquid colloidal solutions. Like most soluble dyes, pigments give best results when added to the stock first, before size and alum. The depth of shade obtained with pigments depends on the stock freeness and the length of time of contact. Of course, the amount of size and alum in the sheet also affects the depth. To obtain uniform runs of colored paper, when using pigments, it is necessary to accurately control the above-mentioned factors.

CHOICE OF COLORS

The colors used in most of the regular grades of papers have become somewhat standardized, although there is considerable variation from mill to mill. In matching a new color to a competitive sample, it is common practice to attempt to determine the colors that were used in the competitive sheet and use the same in matching it. As a matter of fact, this is the only way that a true match may be obtained. However it is possible to make a metameric match, which in many respects, may be better than the original. The principal disadvantage of a metameric match is that it exists only under one type of light. That is, if the match is made under daylight, then the samples usually do not match under incandescent light and vice versa. Fluorescent lights affect most dyes differently than either daylight or incandescent light, but the effect is closer to daylight.

In most mills, the papermakers do not have as much information as they would like or need, as to how their products are used. Quite often, there are qualities put into grades of paper that are not needed, or in many cases, actually undesirable. This situation applies not only to color but to other characteristics, and is especially true with grades that have many uses; sometimes widely different. Many mill specifications are built up from bad experiences or complaints. In the absence of sufficient information on the exact requirements in a given grade of paper it is wise to set the standards high enough to allow a good margin of safety. However, setting the standards higher than necessary usually adds to the cost. The most efficient use of dyestuffs requires that the standards for various qualities, such as fastness to light, acid, alkali, water bleeding, etc. be set high enough, but no higher than necessary. Although it isn't always true that the cheaper dyes have poorer characteristics or vice versa, it is nearly always true that setting the standards at a high level definitely limits the choice of colors and thus increases the cost. This also varies somewhat with the hue and especially with the brilliance.

A wide choice of dyes is available for making the dull shades but for brilliant shades the choice is definitely limited. The choice of dyes available for some hues is decidedly more limited than for others. For example, there are no bright fast-to-light soluble green dyes. Fairly bright fast-to-light green shades may be made with Alizarine Blue and Chinoline Yellow, but there is no choice. These dyes are expensive and each has undesirable characteristics. The Chinoline Yellow may tend to be two-sided on high-speed machines and the Alizarine Blue is sometimes difficult to control because of its continuing shade development for a considerable time after alum has been added to the beater. Pyrazol Fast Turquoise GLL may be used with Chinoline Yellow to produce bright greens that are fairly fast to light but somewhat two-sided. There are two acid and two basic greens that are very brilliant but all have very poor light fastness.

The choice of dyes for making bright greenish blue shades is also rather limited. Alizarine Blue, Turquoise, Soluble Prussian Blue, and Methylene Blue may be used but turquoise and soluble Blue are two-sided and Methylene Blue has poor light fastness and is also two-sided on bleached pulps. Alizarine Blue has the undesirable characteristic of slow development previously mentioned.

Many times a slight difference in shade or brilliance may make a substantial difference in the cost per ton of colored grades. For example, the cost of making a greenish canary shade may be several dollars more per ton than a shade which

is only slightly redder. There are many colored grades which could be made at lower costs by slightly reducing the brilliance. Of course, there are some customers who will insist on the extra brilliance and are willing to pay for it. On the other hand, there are many customers who prefer the slightly duller color at a lower cost. This is especially true, and especially important, when business conditions are highly competitive.

Many color formulas now in use can be improved or reduced in cost or in some cases both, by study and re-matching.

COLOR DIMENSIONS

It may be well to consider briefly some of the theoretical aspects of color. Although most of us know the true nature of color as it affects our eyes, constant association with the materials that produce color may distort our viewpoint. We need to remind ourselves that color, when the word is given its true meaning, is not solid or liquid material—it is energy. The most brilliant colors become black when observed in a darkened room. The dye which we put in the beater to produce colored paper does not add color to the stock, it is merely a substance that has the ability to selectively absorb lights of certain wavelengths and allow lights of other wavelengths to be reflected. (This statement does not apply to fluorescent materials, which actually convert invisible energy to visible light.) That is why the color and intensity of the light source are so important when observing colors or more especially when trying to match them.

Visible light is an extremely small portion of the electromagnetic spectrum ranging from blue violet at 400 to red at 700 mmu. Instead of considering this visible spectrum as a straight line it should be thought of as a circle or a 360° segment of a helix. The reason for this representation is that the hues at each end of the spectrum are approaching each other and when mixed together produce violet. Purples and violet are often referred to as off-spectrum hues but may well be considered as the point where the two ends of the helical segment become superimposed.

In matching colors we use this hue helix or spectrum as one of the dimensions of color. Even color men who are unfamiliar with color curves or the Munsell system or any other system, usually think of hues as being arranged in a circle.

After establishing the first dimension or hue we now consider the second dimension, usually called chroma or intensity. This dimension may be considered at a minimum in grays, whites or blacks and at a theoretical maximum if all the light reflected were monochromatic, that is, confined to a single wavelength. The third dimension is called value or brilliance and is really a measure of the total amount of reflected light.

Applying these principles to a spectrometric color curve, showing the percentage or reflected light at each wavelength, we find that the horizontal location of the peak of the curve represents the wavelength or hue. The shape of the peak represents chroma or intensity; a pointed peak with an acute angle at the apex representing high intensity and a round peak having a wide angle at the apex representing low intensity. The average height of the curve represents value or brilliance. This may be best measured as the area below the curve. As it increases so does the brilliance.

Although there are three separate dimensions to every shade as described above, in actual practice it is practically impossible to vary them individually. For example it is impossible to separate intensity and value because of the fact that dyes are materials that selectively absorb light and when we add dye to increase intensity we automatically lower the value. When we change the hue by adding a dye of different hue to the original, we increase the intensity but lower the value. When we use dyes whose hues are widely separated on the spectrum we reduce both intensity and value and approach gray or black. Thus, in matching colors, we are able to obtain highest intensity and value by using a single base dye, or two, which are close together in hue. Of course, the fundamental brilliance or purity of each individual dye will also affect the final results of the combination.

COLOR MATCHING

Color matching requires natural ability to detect small color differences plus a knowledge of the action required to produce changes necessary for achievement of the desired results. Not everyone has enough ability in color detection to become a good color matcher but knowledge of color and coloring materials is available to all who have the intelligence to understand and the willingness to study.

Color matching in the paper mill requires ability to match wet stock as well as finished paper. Successful matching of wet stock requires considerable experience and knowledge of how individual dyes change from wet stock to dry paper. The greatest difficulty in wet matching is encountered when changing formulas, since individual colors vary widely in their change in appearance from the wet to dry state. However, all commonly used colors are stronger and brighter when wet than when dry.

It is generally accepted that any color can be matched with three dyes, provided of course, the three correct dyes are chosen. However, it is often desirable to use as many as four or five dyes. While it is theoretically possible to make certain shades with one or two colors; in practice it is virtually impossible because of normal variations in the color of pulp, water, fillers, stock treatment etc. Of course, it is not only possible but quite practical to make a shade with one color as a base, using two or three others in small, quantities for shading.

When possible, in making a match, it is desirable to use two colors fairly close together in the spectrum, one on either side of the color to be matched. A third color should be used for dulling. Sometimes the third color may be a brighter dye for topping.

Occasionally it may be advantageous to use dyes which are quite far apart on the spectrum. This is only possible when the shade is somewhat duller than the individual dyes, since spacing on the spectrum dulls the final shade in direct proportion to the amount of separation.

When more than three dyes are used there are usually reasons other than merely to match the color. The reasons may be to reduce two-sidedness, to increase light fastness or to reduce costs. For example, combinations of direct and acid colors are often used to reduce two-sidedness, the acid dye contributing brightness and the direct dye adding color to the wire side. In clay filled sheets, it is usually desirable to use two base colors, one having greater affinity for fiber, the other having greater affinity for clay. Since there is always more clay on the felt side of the sheet than on the wire side it is necessary for bath clay and fiber to be equally colored to avoid two-sidedness. It is often difficult to obtain this with one base color since so few dyes have equal affinity for fiber and filler.

It is often found that fast-to-light colors are too dull to give the desired shade and must be topped with a brighter color that is more fugitive. Thus in order to obtain as much light fastness as possible, it may be desirable to use four or five dyes in the formula.

Most bleached pulps have some degree of color revision. This is especially true of bleached kraft pulps, some of which may revert as much as 12 points in brightness. Thus, when making light shades, the use of fast-to-light colors will not produce paper which is fast to light. To counteract the browning effect of pulp revision it is necessary to add to the formula a combination of fugitive brown dyes which will fade out at the same rate and to the same degree as the color added by the reversion.

Sometimes it is possible to use pulp reversion to advantage. For example, on brown shades the reversion may be used to counteract partial fading of the color. Pulp color reversion

has also been used to reduce the fading of bright oranges by the use of fugitive blue as a dulling color. In fading, the reversion adds brown but the fading out of the blue changes this addition to a bright orange which in turn partially counteracts fading of the orange dye in the formula.

Often it is possible to reduce color cost by using extra dyes in the formula. For example, sometimes bright expensive dyes are dulled back with black or a complementary color to make a match. Fast to light, duller but less expensive colors are not bright enough to match the shade. The best formula in this case will consist of as much of the lower cost dyes as possible with the brighter, more expensive colors used for topping.

When starting a color over the paper machine it is necessary to have extra dye in the stock until the return water comes to equilibrium. On the other hand, it is preferable to start a shade on the light side rather than on the heavy side since it takes longer to add lighter stock and get it mixed in than it does to add color by doping the chests. Some color men prefer to keep the stock light and add color directly to the tray water. Experience with the color formula as well as familiarity with that particular paper machine are essential to the success of this maneuver. When using acid colors it may be wise to use additional size and alum in the first beater to compensate for the fresh water. It is also desirable to adjust the pH to the proper level in the beaters and in the tray water, especially when the dyes in the formula are sensitive to pH. This becomes more important when the fresh water is hard, or alkaline or acid. Alum or soda ash may be used to adjust the tray water to the proper pH.

When one color follows another, a match will be obtained more quickly by counteracting the effect of the preceding color. This is especially true when the preceding color contains acid dyes which are retained in the felts and gradually leach out. For example, when a red follows an orange made with acid dyes, it is desirable to start the shade slightly on the blue side. As the effect of the orange becomes less, the formula must be adjusted accordingly.

COLOR INSTRUMENTATION

Although there are many instruments available for measuring various characteristics of color, the human eye is still the best instrument for matching. However, instruments such as the G. E. Recording Spectrophotometer, brightness tester, PPG-IDL Color Eye, and similar instruments are very useful for keeping records and setting up standards. A color curve made with a prism spectrophotometer, such as the G. E. recording instrument, makes the best fundamental standard. Only the curves of true matches will coincide exactly. Curves of metameric matches may show substantial difference. Thus when one or more dyes in a formula are changed, a new standard curve must be established. In mills where a prism spectrophotometer is not available, filter type instruments such as the G. E. Brightness Tester may be used to make standard color curves. While not as accurate as curves made by the prism instruments, they still may be used to good advantage.

pH CONTROL

With modern methods of closely controlling the pH of stock on the paper machine it is now possible to make much greater use of acid-alkali sensitive dyes such as Benzopurpurine 4B, Congo Red, and Benzo Orange R. These colors have very good money value and Benzopurpurine and Congo Red have good light fastness. The bad feature of these colors is their lack of chemical resistance.

CHEMICAL ASSISTANTS

Chemical dyeing assistants are used for several purposes as follows: (1) to prevent graniting, (2) to fix colors and increase water fastness, (3) to increase yield or exhaust.

Graniting of basic dyes in mixed furnishes may be prevent by the use of products such as Cartan O or Thiotan M These products also serve as mordants for basic dyes bleached pulps. Thiotan MS is particularly effective in hel ing to retain high concentration of certain basic dyes bleached stocks at the same time improving the water fas ness. This product has also been successfully used as aftertreatment to improve the water fastness of certain ac and direct colors.

Cuprofix and Sandofix may be used as aftertreatments improve the water fastness of selected direct dyes. The products are now widely used on textiles.

Increased yield of selected acid, basic, and direct dyes m be obtained by a new product dalled Decalsate. Some the products mentioned above as well as several others the market have been successfully used for this purpos However, the cost of chemicals required to do the job, usually more than the cost of the dyestuff saved, thus makir their use impractical for cost reduction. One of the adva tages of Decalsate is that its cost is low enough so that most dyes, with which it works at all, it will save enough pay for its own cost, plus an additional saving that w vary with each individual formula. A bad feature of th product is that it is selective, not only to dyes but to pulp With a majority of dyes it increases the yield, with othe it has no effect, and on some it reduces the yield. Therefo it cannot be used indiscriminately. Each formula for i use must be worked out individually. In general, this pro uct works better with alkaline than with acid cooked pulp That is, it may improve the yield of certain dyes on bleache kraft but no effect with the same dyes on bleached sulphit

SURFACE APPLICATION OF COLOR

Many of the fundamental principles of beater dyeing w hold for the other methods of applying color to paper. Ho ever, there are certain features of each method that are co siderably different. We shall consider each of the other met ods briefly with emphasis on the differences between each

Calender Coloring

Staining on the calender stack is confined to heavyweig paper and boards, usually the cheaper grades. The princi advantage of this method is low cost, especially on heav weight boards where the ratio of surface area to unit weig is low. The principal disadvantages of this method are th the colored surfaces are not water fast and the color may somewhat uneven on hard sized papers.

Application is made in regular water boxes, one or two f each surface. Best results are obtained by having the box equipped with overflows returning excess color solution circulating tank from where it is pumped back to the boxe a separate tank for dissolving the dye is necessary.

A steam coil or other means of heating is also desirable i the circulating tank since the most even coloring is obtaine when the solution temperature is maintained at 160 to 180°

Only dyes with good water solubility are suitable for surfac coloring. Acid dyes are most widely used but there a many basics and even a few direct dyes that give satisfactor results.

A few acid dyes which canot be used for beater dyein because of poor retention, give excellent results in surfac coloring. These include, Azo Rhodine 2G, Ponceau, Naph thol Yellow, and Tartrazine.

To help dissolve acid colors, small quantities of mild alka such as soda ash are often used. With basic dyes a sma amount of acetic acid will help to make a good solution.

Surface-active agents, or solvents such as denatured alc hol, butyl carbitol, etc., help to give more even penetratio and thus a more level dyeing, especially when the paper hard sized. Many mills use hydrolyzed starch, natur gums, methyl cellulose, carboxymethyl cellulose, urea fo

maldehyde solutions or various synthetic resin emulsions with the color solution. The reasons for using these products are to obtain better printing surfaces and/or to increase oil or water resistance.

Some mills use a size press to add color to the wire side on grades that would otherwise be two-sided. While this is not calender coloring, the same principles apply. Usually the amount of color added is much less than for calender coloring and therefore it is possible to use some of the less soluble colors.

A process that is being used more and more, and is somewhat different than regular calender coloring, is the application of fluorescent whites to the surface of paper or board in the size press or on the calender stack. The use of these materials is somewhat similar to calender coloring except that the object is to produce brighter whites instead of colors and the amount of fluorescent white used is much less than the dyes used in surface coloring. For reasons of economy it is desirable to keep these products on the surface. Therefore it is recommended that they be used with gums such as mannogalactan, sodium alginate, or hydrolyzed starches.

Dipping

Dyes suitable for calender staining are also suitable for dipping. The process of dipping, or padding, as it is sometimes called, is used primarily for staining tissues. The sheet is completely immersed in the color solution by passing under a submerged roll. Thus, although it is a surface application, the color goes through the entire sheet and is not confined to the surface as in calender staining or coating.

The amount of paper colored by this method is much less than that produced by any of the other methods.

Coating

The amount of coated paper produced in this country for 1953 will probably exceed $1^1/_2$ million tons. While only a comparatively small proportion of this amount is highly colored paper, all of it probably has some color or tinting. Although modern paper coating includes many types such as hot melt resins and varnish coatings, we shall confine this discussion to conventional water dispersed coatings. Insofar as the colors that may be used, there is no difference between machine or converter coating, or brush roll, or cast coatings. Therefore we make no distinction among these various types. However, there is a difference in the colors that may be used in starch coatings containing neutral inactive pigments and casein coatings or coatings containing alkaline pigments such as satin white. Only colors which are fast to alkali may be used with casein or alkaline pigments.

In coatings, the word pigment may be somewhat confusing since it refers to white pigments such as clay, talc, calcium carbonate, titanium dioxide, satin white, barium sulphate, etc. and also to colored pigments. The best dyes for coating are those that have affinity for both pigment and binder but affinity for the pigment is probably more important.

All classes of colors may be used for coating, but acids and basics are most widely used. For deeply colored coatings very good solubility is required, but for tintings some of the less soluble dyes may be used. Fluorescent whites are now being used to obtain increased brilliance in white coatings.

Printing

The subject of printing, as applied to text or illustration, does not belong in this discussion. However, there are many mills printing over-all colored designs on papers to be used for fancy wrapping, box liners, greeting cards, etc. Some of these are rotogravure printings with oil, ink, and others are so-called aniline printings made with colors dissolved in alcohol, plus shellac or alcohol soluble resins.

CONCLUSION

Although the résumé of the various methods of applying color to paper is by no means complete, it does indicate the wide variety of tools available to the papermaker for creating attractive as well as useful products.

EMPLOYMENT SERVICE

Positions Wanted

E259-54. Superintendent available. Experienced in printing papers, free sheets, bleached sulphate and sulphite papers, tissues and facials, carbonizing grades, glassine and greaseproof. Yankee or fourdrinier type operation. Middle age.

E260-54. Chief Engineer. Several years' experience in engineering, maintenance, operational and management positions. Desires employment by progressive pulp or paper company.

E261-54. Pulping technologist, professional education and 5 years' experience in research, pilot operations, and production, desires permanent responsible position with firm using, or planning to use, the NSSC method of pulping. Married with family, would prefer location in the northeast, but willing to consider other areas. Available about July.

E262-54. Graduate, British, technical expert in bleached and brown pulp production from straws, bamboo, annual crops, etc. for all paper grades. 10 years' production and development experience in Europe and the East, covering all processes in current use. Offer services as Technical or Development Director, Research Manager, or similar capacity in existing mill, or as Design Consultant in new project. Any location considered.

E263-54. Assistant to an executive in charge of pulp production costs. Well versed in the new developments (involving the cleaning of rough woods, wood chips and pulps, and the most recent pulping and bleaching procedures), in the utilization of waste or rough woods without lowering the end-use qualities of standard pulps. Ph.D. training, presently employed, married. Strong background in applied research with some mill experience.

Positions Open

P349-54. Process Engineer. Expanding technical department of progressive Wisconsin paper mill desires a graduate chemical engineer or paper technologist for process engineering studies. Some experience in paper manufacture desirable. Unusual opportunity for advancement. Age 25–35. Reply to Gilbert Schreiber, Personnel Director, Wausau Paper Mills Co., Brokaw, Wis.

P358-54. Midwest mill manufacturing kraft specialty papers needs man with training and some experience in technical phases of papermaking as mill chemist. Will supervise laboratory personnel and handle special development projects. Color experience desirable. Salary open. This is an excellent opportunity for the right man.

P359-54. Young technical man who has fulfilled military service obligation and who has had five years' or less experience in a paper mill for work in a fine paper mill in New England for

GENERAL SUPERINTENDENT — INDIA

P361-54. Experienced General Superintendent to take charge of complete mill, operating in Central India, making 25–35 Tons daily, of fine papers from bleached chemical bamboo and rag stock on 135" Fourdrinier. Mill expansion being contemplated. Engagement could be on contract basis including free furnished living quarters, transportation paid to and fro for both initial period, and in case of contract being renewed, Home Leave. Salary range $600.00 to 700.00 monthly. Please give particulars of age, experience, education, etc. and photo if possible. Position provides opportunity for advancement.

TOUR BOSS — INDIA

P362-54. Experienced Paper Maker to act as Tour Boss in mill making paper from grass and rags. Please give full particulars of age, experience, etc. and salary expected. Replies should be sent to *Tappi*, 155 East 44th St., New York 17, N. Y.

laboratory research and mill investigations to solve certain manufacturing problems.

P360-54. Man, age 25–35, with chemical training and preferably 2–3 years' paper mill experience for technical sales-service position calling on paper mills and corrugating plants for chemical manufacturer. Reply giving education, experience, and salary expected.

P363-54. Paper Salesman. Established manufacturing concern desires young man between 30–35 years of age to sell chemical specialties to paper industry. Qualifications must include experience in technical or production end of paper industry. Chemical background essential. Excellent opportunity for man demonstrating initiative and sales ability. Please give details of education, experience and salary desired.

P364-54. Chemist. Experienced in adhesives for development work with spent sulphite liquors. Wisconsin location. Give complete information in first letter.

P365-54. Technical Director for new and expanding pulp mill. Chemical engineering graduate with at least ten years' experience in the manufacture of bleached kraft pulp and high grade white papers. Must have had enough experience in directing technical work in these fields to qualify him to assume full responsibility for the management of Technical Department. This would include the supervision of laboratory, quality and process control, process and product development.

All replies will be kept in strict confidence. Please make your résumé as complete as possible and furnish recent photograph. Our employees know about this advertisement.

Note: Responses to employment ads should be addressed to box number, *Tappi*, c/o Technical Association of the Pulp and Paper Industry, 155 E. 44th St., New York 17, N. Y.

LETTERS TO THE EDITOR

Standard Pulp Samples

To the Editor, *Tappi:*

The Pulp Testing Committee is considering the establishment of a program to serve the industry by maintaining a "standard pulp." Samples of this pulp would be supplied at a nominal cost (probably $5.00 for a 5-lb. package).

This pulp could be used for reference purposes for all kinds of tests, both physical (beater, ball mill, etc.) and chemical (alpha-cellulose, lignin, etc.). In addition a request would be made for each user of this pulp to submit the results of his analyses to TAPPI Headquarters. These results then would be compiled, averaged, and recorded. The average values of all the tests would be published in *Tappi* if enough interest is shown.

The Pulp Testing Committee would appreciate receiving from members of industry, expressions of opinions relative to the establishment of a "standard pulp" program. The committee would like to know how many would be interested in having a reference pulp made available at a nominal fee?

Would you please publish this letter in *Tappi* and arrange to have the answers forwarded to me?

FRANK E. CASKEY, *Chairman*
Pulp Testing Committee

Ed. Note: Responses to this letter should be sent to Frank E. Caskey, Crown Zellerbach Corp., Central Research Dept., Camas, Wash.

Fifth Coating Conference
Technical Association
of the
Pulp and Paper Industry
Poland Spring House, Poland Spring, Me.
May 24–26, 1954

Cathodic Protection for the Prevention of Corrosion in Equipment for the Treatment of White Water

F. J. LeFEBVRE

AN ENTIRELY different, although not new, method h been devised for preventing corrosion of equipment for whi water treatment. This method, known as cathodic prote tion, goes back to 1824, when Sir Humphry Davies of Engla experimented with zinc plates to prevent corrosion of sh bottoms. During the next 100 years there was little applic tion of this method, but today cathodic protection plays definite role in corrosion prevention, and is widely used protecting such metal structures as water storage tank equipment for the treatment of water and sewage, dock pilin deep well pumps, and buried pipe lines and cables.

Although large sums are spent on equipment for whi water treatment, additional money must be spent to preve premature failure of the equipment due to corrosion. It significant to note that cathodic protection of equipment f the treatment of white water has been used, up till now, on after signs of corrosion had appeared on existing installation These signs of corrosion have evidenced themselves in pitti of the submerged metal surfaces.

The reasons for corrosion of the submerged metal surfac are varied, and cannot always or easily be eliminated. TI type of corrosion with which we are concerned is electr chemical in nature and can be caused by: immersion of t steel in an acid, alkaline, or even a neutral solution; dissimil metals immersed in an electrolyte; nonuniformity of surfa conditions, which may be attributed to stresses and strains the metal itself; or to what are known as oxygen concentr tion cells.

If a perfect, permanent protective coating were availab we would not be concerned with corrosion. However, suc is not the case, and we must find some other means of pr venting the submerged metal from going into solution. It known fact that coatings develop flaws or holidays wh expose the underlying metal to the corroding media. I at these defects in the coating that accelerated corrosion tak place. If there were some means of sealing these holes in t coating, corrosion could be stopped.

Cathodic protection provides such a means of preventi corrosion. As iron goes into solution it is accompanied by flow of current. In corrosion, current flows from an anodic more electronegative area to a cathodic or less electronegativ area. If this flow of current can be stopped corrosion can b eliminated. Cathodic protection supplies a direct curre which flows from an auxiliary anode, suspended in the ele trolyte, to the entire submerged metal surfaces of the equi ment to be protected. This current negates any curre which has a tendency to leave the submerged surfaces of t equipment and thus corrosion is brought to a halt.

The cathodic protection equipment consists of a rectifi unit, which reduces the a.c. input voltage and converts it direct current. The positive d.c. rectifier output is connecte to an anode, generally aluminum bar stock, suspended in t white water, and the negative output is connected to t equipment to be protected. A complete circuit is now set u and the flow of current is from the positive side of the rectifi unit to the anode suspended in the white water, through t white water to the submerged metal surfaces of the treatme equipment, and back to the negative side of the rectifier uni

There is now a constant flow of direct current to all portion of the submerged equipment and no current is permitted t escape from the wetted surfaces of the equipment and ent

F. J. LEFEBVRE, Chief Engineer, Electro Rust-Proofing Corp., Bellevil N. J.

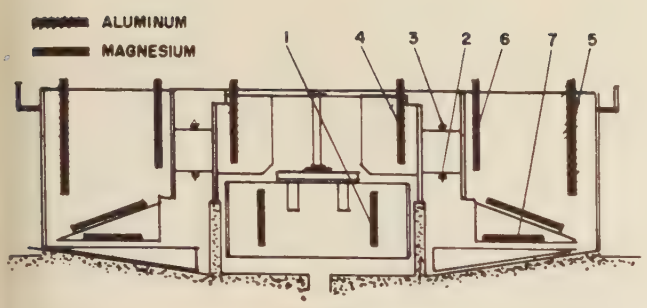


Fig. 1

the white water. The current from the suspended anode or anodes is directed specifically toward the holidays in the paint coating, these being the paths of least resistance.

In inaccessible locations, or where the equipment is in motion, and where the specific resistance of the electrolyte is relatively low, it is possible to use galvanic magnesium as a source of protective current. The magnesium is suspended in the electrolyte and connected directly to the metal surfaces to be protected. The 0.7 v. potential difference between the magnesium and the protected steel is sufficient to drive the protective current through the electrolyte.

It might be appropriate at this time to explain why rectifiers with aluminum or platinum electrodes are sometimes used and why at other times galvanic magnesium is used. It amounts to a matter of economics and engineering design which is governed by the layout of the treatment equipment and the characteristics of the white water. If a high current density is required over a large area it becomes more economical to use a rectifier with an adjustable d.c. output rather than galvanic magnesium. If the area to be protected is on a moving part such as a rake arm, it might be advisable to use magnesium and thus eliminate a brush type of contact which could be a source of trouble. If it is difficult or impossible to take the treatment equipment out of service every year or so, it becomes necessary to use heavy electrode stock good for 2 or 3 years' service or else use nonsacrificial platinum wire as an electrode. The use of platinum wire electrodes of course increases the original installation price but will, in most cases, reduce the over-all cost in the long run because of lower annual service costs.

Because of the complex design of equipment for white water treatment it is necessary to have a great number of anodes as well as several different circuits of anodes in order to provide a flow of current to all submerged parts of the equipment. The electrode configuration of a typical installation is shown in Fig. 1. Note that magnesium anodes are suspended inside the mixing chamber and also mounted on the rake arms of the equipment. Just above and below the baffles in the outer draft tube magnesium ribbon is laid in the form of a circle to protect the baffles, the outside of the inner draft tube, and the inside of the outer draft tube. Aluminum anodes, with a rectifier as a source of current, are used to protect the baffles in the inner draft tube as well as the outside of the outer draft tube and the outside walls of the equipment. After several months of operation (in the particular installation shown), it was noted that the outside walls of the outer draft tube were not receiving adequate protection. Another set of magnesium anodes was then installed just outside of this draft tube and the surface potentials were lowered from −0.650 to −0.930 v. A potential more electronegative than 0.850 v. with reference to a copper-copper sulphate half cell is generally considered to give full protection. At the last inspection there were no signs of further corrosion taking place.

Figure 2 is a plan view of the same installation and clearly shows the number and arrangement of electrodes required to provide adequate protection to all the submerged surfaces.

In an installation in a similar piece of equipment, the raw water inlet was in the form of a triangular conduit around the outer periphery at the bottom of the tank. This was a difficult place to reach and corrosion was taking its toll there. A long-lasting platinum electrode fed by a rectifier unit was installed at this location and corrosion was brought under control. If there is sufficient space to install an electrode and if the electrolyte is conductive, then the submerged metal surface can be protected.

Since most companies do not have stand-by white water treatment equipment, it is essential that the equipment have the minimum out-of-service time. A good cleaning, scraping, and painting job is not only expensive but will take several days to accomplish and must be done approximately every 2 to 3 years. A cathodic protection installation will cost less and will take less time to install than a good cleaning and painting job. The underwater part of the installation can be made and the treatment equipment placed back in operation in less than a day. That part of the installation above water can be made with the equipment in operation.

After the installation has been completed the next step is to make certain that the system is maintained in operation at the prescribed amperage as recommended by the design engineer. While the equipment can be considered automatic in nature, nevertheless the installation should be checked weekly to make certain it is functioning properly. This can easily be done by checking the readings of the meters, which are located on the instrument panel of the rectifier unit.

Regardless of whether the installation is maintained in operation under an annual service contract with the manufacturer or whether the work is performed by plant personnel, the following procedure is recommended:

1. Appoint a responsible person to make regular checks of the installation, and make sure that he understands its operation.
2. Have him read the meters and record the readings at least once a week. Recording of readings may be made on a simple chart and kept for ready reference. If there is a wide difference in the meter readings from those prescribed on the instruction chart, or if a large voltage tap adjustment is necessary to obtain the required meter readings, then immediate action should be taken to remedy the apparent fault.
3. Arrange for prompt replacement of electrode stock when needed either by the manufacturer or the plant personnel.
4. Call for experienced service promptly whenever operating difficulties appear beyond the capabilities of regular personnel.
5. Notify the manufacturer of any change in treatment of white water and at any time the structure is painted. Any change in the items just mentioned may call for a change in the current density applied to the structure.

One of the best ways of determining the effectiveness of the

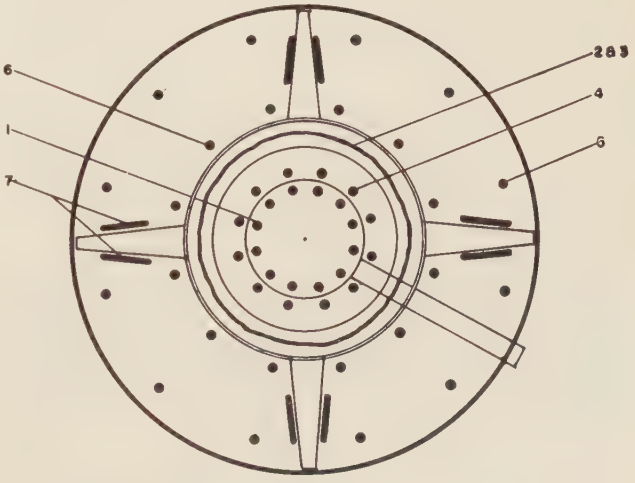


Fig. 2

cathodic protection system is to drain the structure and make a visual inspection of the normally submerged surfaces. The present appearance can then be compared to pictures taken at the time of a previous drain check. While this is an excellent procedure and one to be recommended, it is costly and time-consuming. An alternate method of checking on the effectiveness of the cathodic protection system is to make a potential profile of the submerged metal structure. This can be accomplished while the white water treatment equipment is in operation and without any down time.

This method of testing consists of measuring the structure-to-white water potential by means of a reference electrode placed adjacent to the particular area of the structure to be measured. Since an electronegative potential of 850 millivolts measured with a copper-copper sulphate reference cell is the accepted figure for a protected steel surface immersed in water, a steel surface having a more electronegative potential can also be assumed to be protected. By lowering the reference electrode to various parts of the submerged structure a potential profile can be made of the entire structure. By means of an old technique recently made practicable it is now possible to measure the current density of any particular point of the submerged structure that can be reached with a long extension probe. This method of testing will serve to locate overprotected areas as well as to point out the need of higher current density at other areas.

Cathodic protection systems are today designed to give a high degree of efficiency in protection against corrosion. Regardless of how well designed and installed the system may be it is only by its correct operation and maintenance that protection can be fully realized and corrosion losses kept to a minimum.

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Conversion to the Ammonium Bisulphite Pulping Process

GORDON A. CROWE

The ammonium bisulphite pulping process is currently a subject of much discussion. In this country nine mills, representing a pulp capacity of over 1200 tons per day, have switched to ammonia base. Others are presently conducting tests. Ammonium bisulphite pulping is not a new idea. Its merits have been known for many years. Why then, has it only recently received the serious attention of the industry? The answer seems to be threefold: availability, cost, and legislation.

Adequate and reliable supplies of ammonia are just now becoming available to the paper industry. The increased production which is expected within the next 2 or 3 years will further augment this supply. Soon the shortage of ammonia will no longer be a factor.

There is no denying that a gallon of ammonium bisulphite acid costs more than a gallon of calcium bisulphite acid. This increased cost was once considered to be a serious disadvantage. It is known now, however, that the increase is usually more than offset by savings incident to the use of ammonia.

State legislatures are enacting more and more stringent regulations against stream pollution. The industry is being forced to consider the evaporation and burning of waste liquor. Because of scaling in the evaporator and fly ash from the boiler, calcium liquors present a more difficult disposal problem than do ammonia liquors.

Gordon A. Crowe, Technical Service Representative, Spencer Chemical Co., Kansas City, Mo.

ADVANTAGES OVER CALCIUM

It is not the purpose of this paper to dwell on the advantag of ammonium bisulphite. Briefly stated, however, th advantages are: (1) rapid penetration resulting in shor cooking cycle or lower temperatures, (2) ability to p hardwoods, (3) lower consumption of steam and raw materi (4) absolute control of combined SO_2, (5) no scale formati (6) no sludge to erode acid pumps, (7) fewer screenin (8) lower bleach requirements, (9) improved pulp quali (10) less wear and tear on Jenssen towers, (11) decreas labor costs, (12) increased acid capacity, and (13) m easily evaporated waste liquor.

Operating conditions vary widely. Data from one pl are not always directly applicable to another. For t reason a test run is sometimes desired before definitely co mitting a plant to operation on ammonia base. It should noted, however, that a test run of short duration may not sh the full potential of the ammonium bisulphite proce Material balances on short runs are often of dubious value, a after any major change, time is necessary to determine o mum operating conditions.

ACID TOWER MODIFICATIONS

Design methods and calculations are not presented. Th have been covered in previous publications (*1*). In additi engineering assistance is available from the technical serv sections of the major ammonia suppliers. Instead, we sh pursue a more general discussion of acid equipment, ammo storage and handling, and some of the results that have cently been secured by operation on ammonia base.

The most common raw acid installation is the Jenssen t tower system. To convert a Jenssen tower to ammoni bisulphite, the limestone must be removed and suffici packing material installed to furnish the necessary surf area. This packing may be ceramic rings, broken qua wood blocks or grids, scrap tile, or any other suitably in material of reasonable dimensions. The cost per cubic f varies widely, as does the efficiency. We are thus faced v the choice of a small amount of expensive, efficient packing a large amount of cheaper, inefficient packing. A typ ceramic is 3-in. single spiral tile, costing approximately $2 per cubic foot. At the other extreme we have pulpw blocks, the cost of which may depend largely on the mar of bookkeeping.

For any standard packing it is possible to calculate depth needed in the tower to produce the desired raw a Assume, for instance, that 15 ft. of 3-in. spiral tile are i cated. If the efficiency of 6 by 6-in. wood blocks is o tenth that of the tile (this appears to be the correct orde magnitude), then 150 ft. of blocks are necessary to perf the same job. With an efficient packing only one towe needed. A cheaper packing may require two.

Combined sulphur dioxide in the calcium system is a fu tion of several variables, which are not readily control In contrast, combined sulphur dioxide in the ammonia sys is a function only of the amount of ammonia introdu The increased flexibility with ammonia is obvious.

One precaution that must be observed when modifying raw acid system is to prevent the inert gases leaving the to from stripping out ammonia. As shown in Fig. 1, there two methods by which stripping can be avoided. With first, the water is introduced above the packing and the monia added approximately one third of the way down packed section. The entering water scrubs the exit g free of ammonia. With the second method, approxima 50% of the acid leaving the bottom of the tower is recyc The make-up water and ammonia are added to the rec line. With the proper recycle rate, the liquid entering the of the tower has no appreciable vapor pressure, either of or NH_3. Consequently, there is no stripping by the gases.

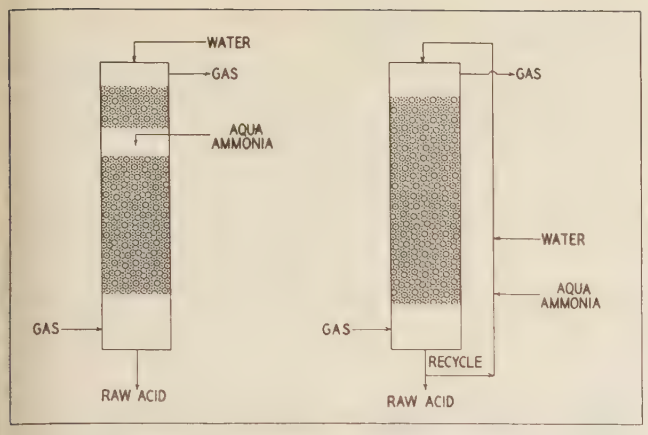

Fig. 1. Jenssen tower conversions

The latter system offers several advantages. A 50% recycle doubles the normal rate of liquid flow over the packing. Provided the liquid flooding rate is not approached, this means better wetting and higher efficiency. Also, there are indications that NH_3, SO_2, and H_2O will sometimes react in the vapor phase to form an ammonium pyrosulphite aerosol. Excessive aerosol formation may plug the tower. Aerosol which escapes not only carries away valuable material, but also it is an air pollution hazard. If the recycle system is used, the ammonia reacts liquid-to-liquid in the recycle line. There is no NH_3 vapor in the tower to form an aerosol. Another advantage of the liquid recycle is the elimination of an extra packing support and spray header within the tower.

The conversion of a Barker tower follows somewhat the same pattern except that there is no rock to remove or packing to add. The ammonia can be introduced on the second plate from the top, or the recycle method can be employed. Since a Barker tower may already be operating nearer the flooding rate than a Jenssen tower, this point should be investigated if the use of a recycle system is contemplated.

AMMONIA STORAGE AND HANDLING

The most economical source of ammonia for large-scale users is anhydrous ammonia supplied in tank cars. Storage equipment for anhydrous ammonia must be designed for a working pressure of 265 p.s.i. A refrigeration compressor is necessary for transferring the ammonia into storage. Some users, therefore, would rather store aqua ammonia. If sufficient space is available the cheapest aqua storage is usually in vented tanks. To prevent loss, the ammonia concentration must be maintained at less than 15 to 25%, depending on temperature.

One tank car of anhydrous ammonia will make approximately 44,000 gal. of 15% solution. A simple and relatively inexpensive aqua system consists of a 50,000-gal. tank equipped with a 300 to 500-g.p.m. all-iron centrifugal pump as shown in Fig. 2. The correct amount of water to dilute one car of anhydrous ammonia is measured into the tank with a depth indicator or a water meter. The circulating pump is then started and the anhydrous ammonia introduced into the mixer. This system requires neither complicated instrumentation nor close supervision. In addition to the diluting tank, a storage tank is required. The amount of storage depends entirely on the desired operating reserve.

The foregoing applies, of course, to permanent installations. For a test run, the ammonia may be purchased either as a 29.4% solution or as anhydrous. If tank car solution is used, it is merely pumped through a flowmeter and into the acid tower. If tank car anhydrous is used, it is either metered directly into the tower or mixed continuously with a small portion of the make-up water and introduced as aqua-ammonia.

During warm weather anhydrous ammonia generates sufficient vapor pressure to unload a tank car into a low pressure process. To assure adequate pressure during cold weather, a thermal unloader should be provided (see Fig. 3). This unloader is a simple heat exchanger, frequently just a vertical tank (approximately 300 gal.) with a steam jacketed side-arm. The vapor from the unloader is fed back into the tank car. The entire unit should be designed for a 300 p.s.i. working pressure and equipped with liquid and vapor connections, relief valve, pressure gage, filling vent, and gage glasses. The vapor line should be insulated.

Anhydrous ammonia is a liquefied gas under high pressure. It should be handled with due caution as explained in the Manufacturing Chemist's Association Chemical Safety Data Sheet SD-8.

CORROSION

Ammonia attacks copper alloys. The rule of thumb is to replace all copper, bronze, and brass that will be in contact with the liquids containing ammonia. Seeking quantitative data on this problem, we subjected samples of brass to a dynamic corrosion test. Two solutions were used.

Solution 1	Solution 2
0.9 mol % NH_3	0.56 mol % NH_3
0.45 mol % SO_2	3.1 mol % SO_2

Solution 1 was run at 30°C. and solution 2 at 150°C. These conditions represent the highest ratios of NH_3 to SO_2 and the highest temperatures likely to be encountered in the raw acid system and the digester system, respectively. The rate of corrosion was:

Solution 1	Solution 2
1.57 mg. per sq. decimeter per day	1061 mg. per sq. decimeter per day

It is known that when brass is subjected to anhydrous ammonia an intercrystalline type of corrosion sometimes occurs. The metal may appear to be in good condition and yet the mechanical strength may be greatly reduced. To determine if ammonium bisulphite solutions cause this type of corrosion, tensile strength tests were made on the corroded samples. As compared with an uncorroded blank, there was no reduction in tensile strength per unit cross-sectional area, indicating no intercrystalline corrosion.

Corrosion in terms of the reported units is difficult to visualize. In more familiar terms, 1061 mg. per sq. decimeter per day means an average loss of 1 mm. from all exposed surfaces every 3 months; 1.57 mg. per sq. decimeter per day corresponds to a loss of 1 mm. every 17 years.

These tests may be somewhat misleading for two reasons. First, they assume uniform loss of material. This is not the case in practice. Once a pit develops, corrosion is accelerated in that area by turbulence. This eventually results in a very uneven surface. Second, again because of turbulence,

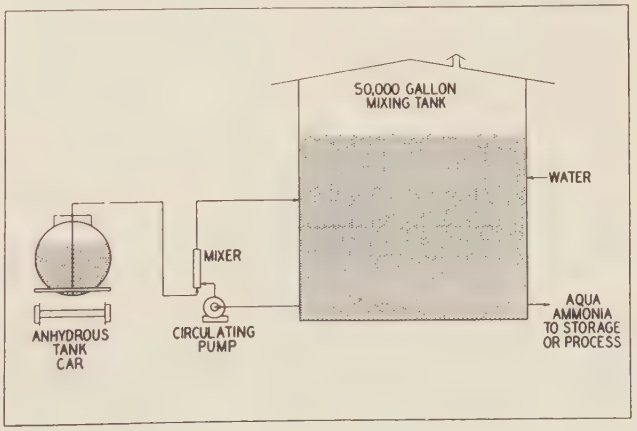

Fig. 2. Aqua ammonia mixing equipment

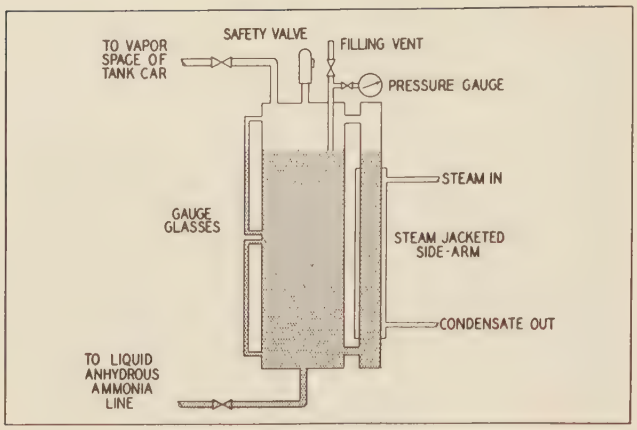

Fig. 3. Thermal unloader

valves and fittings are subject to a greater rate of corrosion. On the basis of these tests we conclude that:

1. For permanent operation on ammonia, it is best that the system contain no copper alloys.
2. For the duration of a test run, and possibly even for permanent operation, copper alloys in the raw acid system should suffer negligible damage.
3. Copper equipment in the digester system could be damaged even during a test run.
4. The solutions tested were acid. Copper exposed to alkaline ammonia solutions corrodes very rapidly.

The ammonium bisulphite solution dissolves all calcium scale in the system, uncovering any small leaks that may exist. Such leaks should become evident during the first few days of operation.

At one time it was believed that conventional linings in digesters, towers, and accumulators would deteriorate rapidly when exposed to ammonium bisulphite liquors. Fortunately, these linings are giving much better service than was anticipated. When permanent operation on ammonia base is contemplated, replacement linings should be of the type employing a dense brick set in furfural resin cement. However, if the litharge and glycerine lining is in good condition, it may give several years of service.

Slime formation is aggravated somewhat by the use of ammonium bisulphite, but this problem can be controlled by using a suitable slimicide.

RESULTS OF TEST RUN

The results of a 23-day ammonia test run made in the Spring of 1952 substantiate previous claims concerning the performance of ammonium bisulphite. The mill making the test was especially interested in the pulping of hardwoods. Some of the conclusions reached by the technical department of this mill are as follows:

1. Ammonia base pulp gave increased yields when the regular mixture of softwoods was used.
2. Cooking time for the regular mixture of softwoods was reduced by at least 1 hr.
3. Pulp quality was as good as and probably slightly better than that of the regular calcium base pulp.
4. A mixture of hardwoods consisting of beech, birch, and maple can be cooked easily in about 7 hr. cooking time.
5. The use of a small percentage of hardwoods will pay for the increased cost of ammonia base.
6. Digester operation is more uniform when ammonia is used, due to clean circulating systems.
7. Bleaching time and chemical requirements can be reduced when the pulp is made from ammonia base acid.

CONCLUSIONS

Ammonia offers many advantages over other bases. Although an adequate supply has not been available, production is increasing rapidly. Two factors that could speed the trend toward ammonium bisulphite are: (1) a solid pulp market, which would make increased capacity desirable, and (2) legislation that would necessitate the evaporation and burni of waste liquors.

A test run on ammonia requires only slight modifications existing acid facilities. Even a permanent installation do not involve great expense. Technical assistance is availal from the ammonia suppliers.

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High Yield Pulping—an Estimate of the Future

C. WILLIAM CONVERSE

During the years since the ending of World War the expansion of high yield pulping processes has been rap These advances are the result of irresistible, economic pr sures among which are:

1. The expanding population requires an ever increas amount of pulp products: paper, paperboard, dissolving pu insulation board, and hardboard while our forests dimin in their ability to supply pulpwood.

2. The cost of pulpwood delivered to the mill yard exceedingly high and continues to increase as does also cost of converting this wood into pulp. Table I indicates trend.

3. The available coniferous pulpwood supply is, at be in balance with cutting and, at worst, diminishing rapi according to the region.

4. The hardwood species, as yet relatively little used pulp production, represent our largest forest reserves and h yield processes produce excellent pulps from most of the ha wood species.

The net effect of these forces is twofold: first, to encou the production of high yield pulps from the coniferous w species and, second, to encourage the utilization of hardw species by conventional cooking methods and by the ne high yield semichemical cooking methods.

Millions of dollars have been spent to improve chem recovery in the kraft process yet, in spite of this careful covery of chemical, most mills recover only about 45% of wood in the form of pulp. Fifty-five per cent of the pulpw so expensively obtained is used for fuel. In sulphite mills problem is even more acute due to the waste disposal probl It is little wonder that there is a strong interest in high y pulping.

In this paper, the term "high yield pulping" includes pulping process adapted to the production of a pulp havin yield of over 50%. Some of these processes are neutral phite semichemical pulping, high yield kraft (brown stock fining), kraft semichemical, and high yield acid sulph Let us now examine the economic problems in the sev pulpmaking regions of the United States.

Table I. Cost of Producing Unbleached Sulphate Pulp 1931, 1935, 1942, and 1946

Wood cost as per cent of total manufacturing cost

	1931	*1935*	*1942*	*194*
Lake States	44.5	43.7	49.9	61.
South	33.7	30.5	46.8	59.
Pacific Northwest	..	33.6	53.1	58.

Source: The Economics of Pulp and Paper, J. A. Guthrie, 1950.

C. William Converse, Manager, Pulp & Paper Mill Div., Sprout, Wal & Co., Inc., Muncy, Pa.

SOUTHERN STATES

Although most kraft mills cook to a yield of 45 to 48%, not all are in this category. Some mills manufacture liner board obtained a yield of 57 to 60% of a pulp that is more suitable for their product than a regular pulp. We can reasonably ask: which mill will be in a better position competitively in a buyer's market: the mill making liner board from 48% yield pulp, or the mill making it from 60% yield pulp? Which mill, in normal times, other costs being equal, will realize the greater profit per ton of product?

It may be argued that the author discusses only one grade. It is true that high yield pulp is not used today in kraft paper grades. Two disadvantages are often brought up in this connection: first, that the high yield pulp contains coarse fibers even after screening, and second, that it is darker than regular pulp. The answer to the first is that equipment is now available that will remove the coarse fibers, and to the second, that a yield of 50 to 55% will produce a light colored pulp and still give a profitable increase in yield.

The production of bleached neutral sulphite semichemical pulp offers the south a new outlet for gum and oak pulpwood. Studies of semichemical pulps made from such wood indicate that they are well suited for fine paper and board grades. Since the annual hardwood cut in the south does not keep pace with the growth increment, bleached neutral sulphite semichemical pulp offers an opportunity for additional pulp production while benefiting the coniferous wood supply since the cut-over land can be replanted with coniferous seedlings.

NORTHEASTERN AND MIDDLE WESTERN STATES

The mills, in general, are heavily dependent upon Canadian coniferous wood. Since that source of supply will soon be lost, their situation is precarious as evidenced by the fact that 25% of the pulpwood consumed in the Lake States is imported from Canada. Yet, many of these mills are surrounded by hardwood forests.

The neutral sulphite semichemical process produces excellent pulps from northern hardwoods; pulps that are suitable for use in bleached and unbleached papers. In northern mills, this process is now producing an increasing amount of bleached pulp in a yield of about 60% for such grades as sulphite bond, writing and printing papers, coated magazine paper, playing card board, and other high quality products. The mills now using bleached neutral sulphite semichemical pulp are leaders in their field and could not afford to use this pulp if it adversely affected the quality of their products.

Another new and commercially proved used for hardwood neutral sulphite semichemical pulp is as a replacement for all, or nearly all the coniferous sulphite in newsprint. When the tonnage of coniferous sulphite that can be replaced in this grade alone is calculated, and the profit accruing from doing so, one can only wonder why every newsprint mill having hardwood available is not following this recent development.

High yield (65%) acid sulphite pulp has also proved to be highly satisfactory in newsprint and is commercially used in this grade. This process is very important in extending the supply of coniferous wood for those mills that do not have useful quantities of hardwood.

The high yield kraft process will produce a 65% yield from northern coniferous wood thus utilizing better the available wood supply. Furthermore, just as with southern woods, the high yield kraft pulp is more suitable for board grades than the usual yield pulp.

PACIFIC COAST STATES

Even in this timber-rich area one of the main pulpwoods, Douglas-fir, is used at a rate in excess of its replacement. Wood costs are high enough to make the high yield kraft process and the kraft semichemical process attractive for liner board and corrugating board pulp production and both are in use. The hardwoods have been largely ignored in this area as a source of pulp. Yet, a conservative estimate places the hardwood volume in Washington at $2\frac{1}{2}$ billion board feet.

NEW PROCESSES

To these opportunities for increasing yields, must be added those presented by recent adaption of known but commercially undeveloped pulping processes. Soluble-base bisulphite cooking, for example, produces excellent high yield pulps from coniferous woods and hardwoods with low sulphur consumption. New methods of impregnating chips with cooking liquor assure uniform cooking of high yield chips, and make continuous digestion more practical.

High yield pulping is in its infancy. Constant improvements are being made in all its phases as new equipment and better techniques are developed. Research in high yield pulping is intense in all pulp-producing countries and in many other countries that wish to produce pulp. Furthermore, equipment manufacturers are developing new pulp mill equipment especially designed for these processes. Equipment and methods for producing clean pulp from low quality wood further extend the wood supply.

High yield pulps have a high bleach demand but the author believes that high yield low lignin content pulps can and will be produced which can be bleached at a reasonable cost.

ESTIMATE OF THE FUTURE

A look into the future always carries a risk and this is no exception. The picture presented here is not based on the projection of production or population curves though these confirm the observations, but rather on raw materials economics.

Within a few years, all test liner board pulp, the author believes, will be produced from high yield kraft pulp. The chemical pulp furnish in newsprint will be either high yield coniferous acid sulphite or unbleached hardwood neutral sulphite pulp, depending on the wood supply available to each mill. Soluble-base bisulphite pulping may well become the leading process for pulping northern coniferous wood for high grade pulp production. It will produce a yield of 55 to 60% bleached pulp. Bleached hardwood neutral sulphite semichemical pulp production will continue to expand and will replace, in large measure, bleached sulphite in book, printing, and writing grades. Unbleached hardwood neutral sulphite semichemical pulp will replace unbleached sulphite in many grades.

High yield kraft pulping will be adapted to the production of paper grades through improved cooking and dirt separation procedures.

The use of continuous digesters will go hand in hand with the development of high yield pulping.

The change to high yield pulp for liner board should be completed within 5 years. The conversion within the newsprint industry should be very far along in 5 to 10 years. The widespread use of hardwood neutral sulphite semichemical pulp in bleached and unbleached papers will come within 10 years. High yield kraft paper grade pulp will come within 10 years.

CONCLUSION

The author has attempted in this paper to follow the trends in pulp production methods which because they are scattered throughout the industry are not strongly apparent to the casual observer. Of this we can be sure: a revolution in pulp production is in progress. It is in the early stages and the author has attempted to project its effect in his estimate of the future. The wise executive will not decide that the revolution will by-pass his mill and his grades but rather he will find out how his firm can profit from it.

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Conservation of Water in the Kraft Pulp and Paper Industry

H. W. GEHM and W. A. MOGGIO

WATER is a primary requisite to life; for plants, animals, and industry, alike. Few industries can long survive where water is unavailable or inadequate as to quantity and quality. Access to and use of water is a major resource problem. This does not mean, however, that we have reached the limits of our nation's water resources. U. S. Weather Bureau figures show an average annual precipitation over the United States of 30 in. The U. S. Geological Survey figures show that 21.5 in. of rainfall annually returns to the atmosphere through evaporation and plant respiration. Another 8.5 in. of precipitation runs off the surface of the land or through the ground directly into streams and thence into the oceans. Only about 0.75 in. of this water is intercepted annually and used directly by man. It is obvious then that there are tremendous possibilities for increasing the volume of water intercepted for use by the public and industry. A large proportion of this potential supply of water, however, cannot be developed in a matter of a few years or even decades.

Nevertheless, the fact remains that until these tremendous reserves are developed, industry and the public in many areas are faced with the immediate problem of obtaining a water supply which is adequate in quantity and quality. If industry and the resulting community development in these areas are to continue growing steps must be taken to increase the efficiency in the utilization of currently available water supplies through such measures as pollution abatement and increased water reuse.

A tremendous increase in size of the kraft pulp and paper industry has taken place since the first kraft mill was operated in this country in 1910. The greatest increase has been from 1939 to date with approximately 3 million tons of kraft pulp produced in 1939 and 7.5 million tons produced in 1950. During that period many new kraft mills were built at new sites but for the most part this increased production occurred at existing mills as a result of expanded production facilities. Great strides were made in water conservation at these existing mills since, in many instances, what was once a more than adequate water supply by previous standards became an inadequate water supply as a result of the increased production capacity. This stimulated water conservation practices and greater reuse of process waters. Increased emphasis on stream improvement programs during this period also served as a stimulus to water conservation in the mills. Other contributing factors were new and improved process equipment and the fact that it is just good business to conserve resources within reasonable economic limits. The entire pulp and paper industry has always been conscious of resource conservation, with particular reference to timber, and this consciousness has carried over into water conservation. It is interesting to note that of the three renewable natural resources—soil, water, and timber—the pulp and paper industry is a major user of all three. Perpetuation of the industry then is dependent on a wise and farsighted policy of resource conservation and replenishment.

A sufficient quantity of acceptable quality water is a necessity in kraft pulp and paper manufacturing operations. Water is one of the most important raw materials. Water has an important function in all the steps of pulp treatment from the moment that pulps are made until they are ready to be used in the finished products. It is used for power, steam, cooling, condensing, and creating vacuums. Primarily, however, water is used in the preparation of the coo ing liquor and in the cooking operation, in pulp washi bleaching, sheet formation, and as a carrier for the p throughout the manufacturing operation. With the reali tion that the use of superfluous water tends to increase fib chemical, and dissolved wood substance losses, kraft mar facturers are making continuing efforts to reduce water co sumption per ton of pulp.

H. W. GEHM, Technical Adviser, National Council for Stream Improvement, New York, N. Y., and W. A. MOGGIO, Resident Engineer, Southern Region, National Council for Stream Improvement, Louisiana State University, Baton Rouge, La.

Table I. Maximum Water Requirements per Ton of Kra Pulp

Part of process	*Gal./ton*
Wood preparation	10,000
Liquor making	35,000
Fiber preparation	15,000
Machine operation	10,000
Fresh water showers	25,000
Steam and power	15,000
Miscellaneous	5,000
Total	115,000

In order to provide a basis for comparison as to the effecti ness of water conservation and reuse measures in the kr industry, reference is made to Table I, which was origina compiled by H. J. Skinner (*1*). The figures shown are r actual operating figures but are approximate water requi ments used in preparing estimates of water usage in new stallations. These figures are to be considered as maximu which may be materially reduced if a mill is designed and op ated with a view to water economy.

Water requirements for bleaching operations, estimated the same basis as the other figures in Table I, can be conser tively predicted as 40,000 to 60,000 gal. per ton pulp. Ma mum water requirements (no reuse of process waters) kraft pulping and bleaching operations would then total 17 000 gal. per ton of pulp.

Comparison of these values with actual water usage figu compiled (see Appendix I) in the 1930's and early 1940 reveal that appreciable water savings are possible even w elementary attempts at process water reuse. Actual wa usage figures for kraft pulp and paper mills from 1942 to da have been considerably lower than the maximum quantit shown in Table I and the trend has been in the direction lower water usage with the growth of the industry up to t present time.

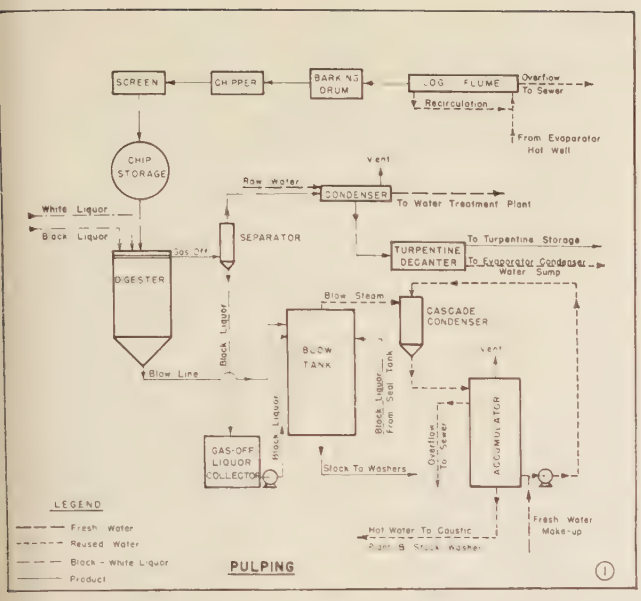
As far back as 1936, C. M. Baker (*2*) compiled a series water usage and fiber loss figures showing what he consider excellent and tolerant values where relatively complete wh water utilization has been developed. This compilation shown in Table II.

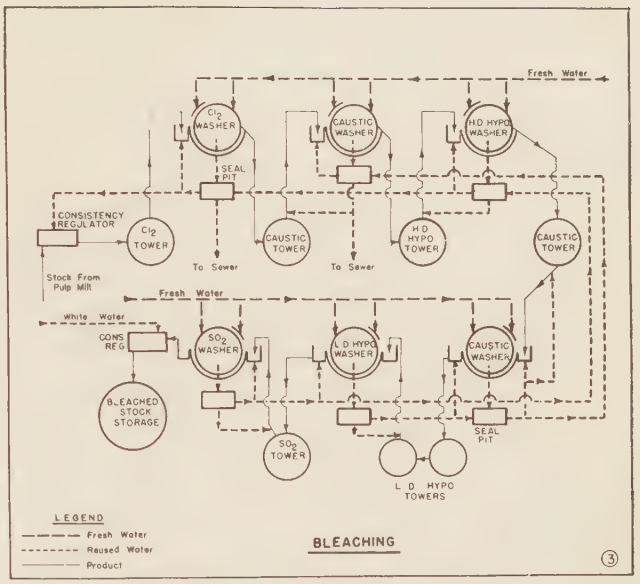
Baker's values for water usage and fiber losses have be attained in actual practice in the period since 1936 and t most recent data (see Appendix I) indicate that the kr industry is exceeding even the high standards set by Baker

Available data show that present-day kraft pulp and pa mills with highly developed water conservation measures effect are capable of operating successfully utilizing 20,000 30,000 gal. of water per ton of pulp. In these same m fiber losses range from 0.5 to 1.5% with B.O.D. (5 day, 20° discharges in the range of 20 to 30 lb. per ton of product.

Table II. Water Usage and Fiber Loss Values

Product made	*—Fresh water, gal./ton—* *Excellent*	*Tolerant*	*—Fiber losses, %* *Excellent*	*Tolera*
Pulp mill, unbleached	20,000	30,000	1.00	1.7
Pulp mill, bleached	25,000	40,000	1.25	2.0
Paper mill	10,000	20,000	1.00	1.7
Pulp (unbleached) and paper	25,000	35,000	1.50	2.2
Pulp (bleached) and paper	30,000	45,000	1.75	2.5

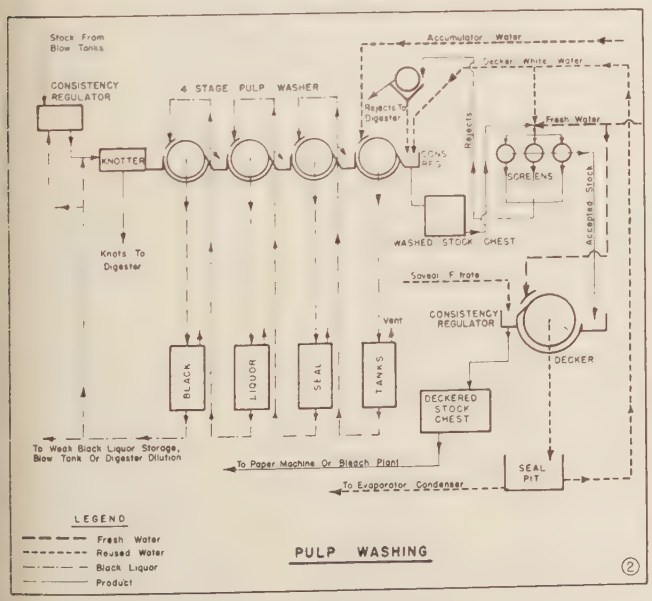


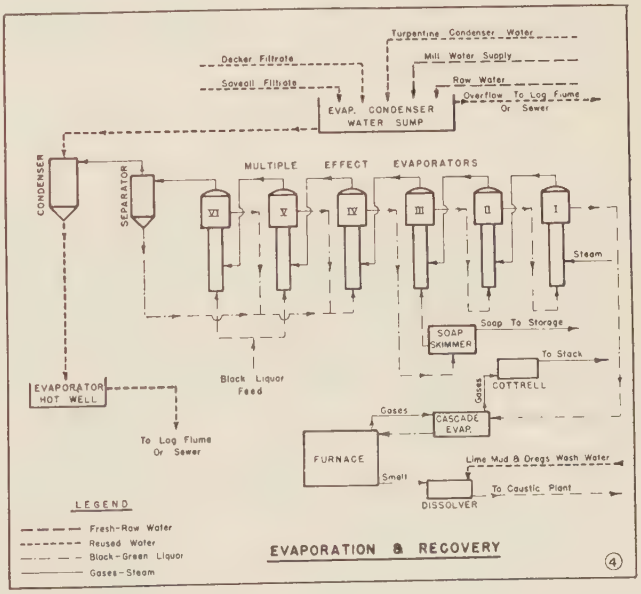


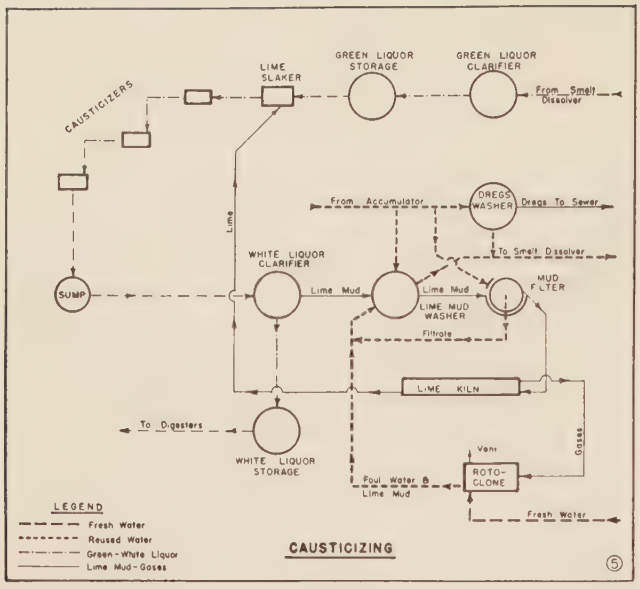
By what means were these remarkable decreases in water consumption per ton of product brought about? Basically, they were accomplished through the reuse of process waters throughout the manufacturing operation. The greatest percentage of reusable process water consists of so-called "white water." This term includes the water from the paper machines in the paper mill and water which has been previously used to convey pulp through the system and has been extracted from the final product in the pulp mill. Great strides have been made in the reuse of white waters in pulp and paper mills but there are limitations to the amount of reuse which can be practiced, particularly in the papermaking operations. White water in continuous recirculation contains impurities which are constantly augmented. Water quality deteriorates to the point where it is no longer suitable for the purpose it is intended. Too tightly closed recirculation systems may lead to troubles such as bacterial sliming, excess retained heat, reduced machine speeds and production, excessive foaming, reduced paper quality, sizing difficulties, and increased equipment corrosion. Nevertheless, with certain changes and modifications, it has been possible to materially reduce water consumption through judicious reuse of white waters. The development and use of satisfactory bactericides and slimicides has been a major contributing factor in permitting wider latitudes in white water reuse in papermaking operations. The reuse of dilute black liquor for liquor volume make-up in digesters and the use of cooling water from turpentine condensers and condensate from digester blowdown in pulp washing operations are factors in reducing fresh water usage in pulp mill operations. Likewise, the white water obtained from deckers in thickening or concentrating pulp stock is reused in thinning fresh stock for screening operations. In bleaching operations the effluent from the various washing operations is extensively reused for consistency regulation and stock movement.

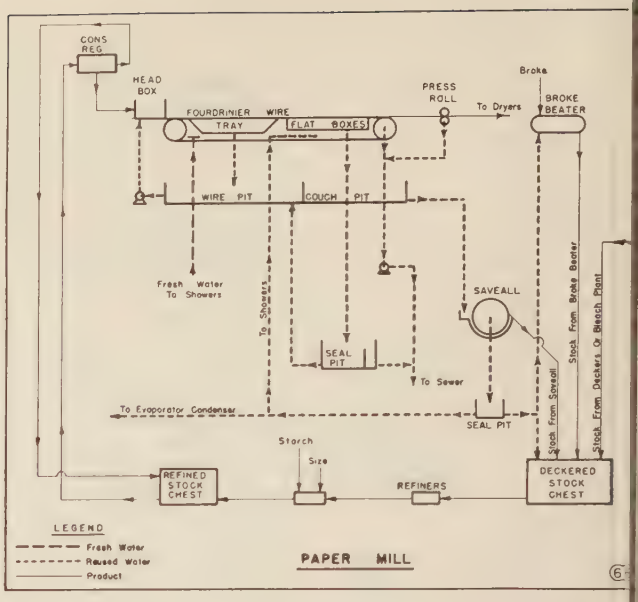
Another major contributing factor in water conservation in the kraft industry has been the introduction of new types of equipment and equipment improvement. This includes process as well as recovery equipment.

The use of vacuum filter-type brown stock washers in the place of diffusers has resulted in a closed system with no sewer discharge, less dilution of black liquor, and lower heat losses among other advantages. Better evaporator and furnace equipment have also been instrumental in decreasing sewer losses. New or modified equipment permitting refining, transportation, and bleaching of pulp stock at higher consistencies have aided materially in water conservation since the volume of water required per unit quantity of pulp is decreased. Improvements in caustic room equipment have resulted in increased efficiencies and have lowered water con-









sumption. The use of vacuum filters as deckers has also contributed to water conservation by reducing fiber losses in the filtrate or white water, thereby permitting the reuse of this white water as process water.

Newer types of white water savealls have also been effective in decreasing the use of fresh water in kraft pulp and paper mills. This type of equipment removes fiber and other suspended material from white water, yielding an effluent virtually free of fiber thereby permitting its reuse instead of necessitating the discharge of white water to the sewer because of its limitations for reuse on account of its fiber content.

Figures 1 and 6 are graphic demonstrations of water reuse in all types of kraft pulp and paper making operations, including bleaching and chemical recovery systems. These flow diagrams are based on actual installations. It is obvious, upon examination of these diagrams, that water reuse in a kraft mill is a complex and intricate undertaking involving a great deal of study and planning in each instance. As such, water reuse is not the type of operation which can be accomplished overnight. Rather, it is a gradual undertaking dependent on many influencing factors, such as, new and modified types of equipment and limitations thereof, types of products manufactured and quality of these products, availability of fresh water supplies, expanding production facilities, etc.

Water usage per ton of product in the kraft pulp and paper industry has declined steadily to a remarkable degree in the past 20 years. The factors primarily responsible for bringing about this improvement have been:

1. Insufficient volume of desirable water supply due to diminishing quantity of existing supply or to expanded pulp and pap production at existing mill sites.
2. Increased knowledge and understanding of water quali and quantity requirements in the manufacturing processes.
3. New techniques of manufacture and water treatment.
4. Pollution abatement and stream improvement consider tions.
5. Economy in the manufacturing operations.

These marked improvements in water consumption in t kraft pulp and paper industry have been achieved by expand reuse of process water and a decrease in fresh water u through:

1. Development of new process equipment and improv design of existing equipment resulting in greater flexibility a decreased maintenance, hence, lower product and process wa losses and greater efficiency.
2. Development of new waste water handling equipment a improved design of existing equipment permitting wider appli tion of the water reuse principle.

It is particularly noteworthy that the decrease in wa consumption per ton of product was accompanied by a cor sponding decrease in fiber and salt cake losses, and of perha greater significance, by a marked decrease in the pollution load discharged to the water courses. Although the effe of the latter improvement may be considered as indirect it nevertheless, a contribution toward the conservation of c water resources.

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Appendix I

Year	*Type of kraft mill*	*Waste flow, gal./ton prod.*	*5 day, 20°C. B.O.D. P.p.m.*	*5 day, 20°C. B.O.D. Lb./ton prod.*	*Fiber loss, %*	*Na_2SO_4, lb./1000 gal.*	*Remarks*
1930	Pulp and paper (*1*)	71,350 (av.)	...	119	...	...	...
	Pulp and paper (*1*)	141,000 (av.)	...	438	...	...	...
1936	Pulp and paper (*2*)	32,000 (av.)	...	...	1.2	...	...
	Pulp and paper (*2*)	71,000 (av.)	...	...	1.6	...	Note A
1938	Pulp (*3*)	64,000 (av.)	123	66	...	...	...
to	Paper (*3*)	39,000 (av.)	19	6.2	...	...	Note B
1942	Paper + bleach (*3*)	47,000 (av.)	24	9.4	...	...	Note B
1942	Pulp (*4*)	34,600 (av.)	...	...	...	...	...
		57,000 (max.)	...	...	...	...	...
		11,000 (min.)	...	...	...	...	...
	Pulp + bleach (*4*)	36,000 (av.)	...	...	...	...	...
		67,000 (max.)	...	...	...	...	...
		5,000 (min.)	...	...	...	...	...
	Pulp + total bleach (*4*)	92,300 (av.)	...	...	...	...	...

Appendix I (*Continued*)

Year	Type of kraft mill	Waste flow, gal./ton prod.	5 day 20°C. B.O.D. P.p.m.	5 day 20°C. B.O.D. Lb./ton prod.	Fiber loss, %	Na_2SO_4, lb./1000 gal.	Remarks
	Paper (*4*)	9,000 (av.)	...	...	...	...	Note C
		16,000 (max.)	...	...	...	...	...
		2,000 (min.)	...	...	...	...	...
	Paper (*4*)	36,100 (av.)					
		84,700 (max.)	...	...	...	...	...
		15,000 (min.)	...	...	...	...	...
	Pulp (*5*)	100,000 (max.)	...	...	...	...	Note D
	Paper (*5*)	40,000	...	...	...	...	Note E
1945	Pulp and paper (*6*)						
	Pulp mill	20,945	...	...	0.34	23.0	...
	Paper mill	57,600	...	...	2.82	0.1	...
	Pulp and paper (*6*)	20,340	115	19.5	...	...	Note F
	Pulp and paper (*6*)	64,000	...	...	0.80	0.92	Note G
	Pulp and paper (*6*)	17,580	...	...	3.07	1.38	Note F
	Pulp and paper (*6*)						
	Pulp mill	16,960	...	...	0.78	4.90	Note A
	Paper mill	2,710	...	...	0.43	...	...
	Pulp and paper (*6*)						
	Pulp mill	15,650	...	...	...	...	Note A
	Paper mill	3,350	...	...	...	...	...
	Pulp and paper (*6*)	96,000	...	...	2.59	2.94	Note A
	Pulp and paper (*6*)						
	Pulp mill	19,710	...	...	0.83	4.75	...
	Paper mill	4,050	...	...	0.06	0.03	...
	Pulp and paper (*6*)						
	Pulp mill	27,670	...	...	3.08	...	...
	Paper mill	2,785	...	...	0.15	...	...
	Pulp and paper (*6*)	14,910	...	...	...	10.3	Note A
	Pulp and paper (*6*)	35,630	...	...	2.60	5.24	Note G
	Pulp and paper (*6*)						
	Pulp mill	1,740	...	...	0.36	2.7	...
	Paper mill	12,500	...	...	1.38	1.63	...
	Pulp and paper (*6*)	64,000	...	...	2.05	...	Note A
	Pulp and paper (*6*)	18,840	...	...	0.66	6.8	...
	Pulp and paper (*6*)	62,840	...	...	...	...	Note A
	Pulp and paper (*6*)	27,150	...	...	...	4.0	...
	Pulp and paper (*6*)	59,900	...	...	...	...	...
	Pulp and paper (*6*)						
	Pulp mill	85,520	...	...	2.44	2.96	Note A
	Paper mill	20,000	...	...	1.70	...	...
	Pulp and paper (*6*)	39,960	...	...	1.23	...	...
	Pulp and paper (*7*)	71,030	114	67	2.3		
	Pulp and paper (*7*)	56,820	120	57	1.7		
	Pulp and paper (*7*)	57,630	163	78	1.5		
	Pulp and paper (*7*)	52,400	85	37	3.1		
	Pulp and paper (*7*)	86,290	109	78	1.6		
1946	Pulp and paper (*7*)	71,030	166	98	3.9		
	Pulp and paper (*7*)	56,820	243	115	3.6		
	Pulp and paper (*7*)	57,630	161	77	1.3		
	Pulp and paper (*7*)	52,420	108	17	4.6		
	Pulp and paper (*7*)	86,290	66	47	1.9	...	...
	Pulp and paper (*6*)	33,100	500	126	...	...	Note A
1949	Pulp and paper (*6*)	39,000	240	73	...	...	Note A
	Pulp and paper (*6*)						
	Pulp mill	18,200	132	20	0.52	0.94	Note H
	Paper mill	2,285	48	1	0.31	0.82	
1950	Pulp and paper (*8*)	35,000	...	...	...	...	...
	Pulp and paper (*8*)	53,000	...	...	...	...	Note A
	Pulp and paper (*6*)	37,200	260	80	2.7	4.05	Note I
1952	Pulp and paper (*6*)	21,300	164	29	0.54	1.99	...
	Pulp and paper (*6*)						
	Pulp mill	25,400	161	34			
	Paper mill	2,000	126	2.1	...	...	...
	Pulp and paper (*6*)	20,000	...	...	1.3	5.32	Note A
	Pulp and paper (*6*)	28,800	...	...	1.6	7.85	Note G
	Pulp and paper (*6*)	21,200	...	...	0.36	3.57	...

1. Warrick, L. F., and Watson, K. M., "Pollution Surveys in Wisconsin Paper Mills," *Paper Trade J.* (June, 1930).
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(A) Includes bleaching.
(B) Various types.
(C) Container board.
(D) Average range 30,000–50,000 gal./ton.
(E) With efficient white water reuse.
(F) Includes groundwood.
(G) Includes semichemical and bleaching.
(H) Vacuum pulp washers.
(I) Includes semichemical vacuum pulp washers (70%), diffusers (30%), cylinder machines (30%), fourdrinier (70%). Insufficient saveall capacity.

The Application of Noncorrosive Materials

GEORGE R. LYDICK

In starting a discussion of the use of noncorrosive materials, an over-all picture covering the use of these materials as they are applied generally is first to be considered. Naturally, this falls into the following: (1) the way these materials are used in the sulphite pulp and paper mills, (2) in their application in the kraft or soda process mills. It is only logical to discuss this in the light of the differences that exist between the two processes. Of course, there is a great deal of overlapping between the two processes in the use of noncorrosive materials, and naturally many of them are used in both. Since the sulphite process is strictly an acid process for conversion of the wood chips into pulp, there are some differences that must be recognized and discussed independently. Those things that apply to the kraft or soda process mills have their own peculiarities that are not encountered in the sulphite mills.

Let us look at some of the materials that might be very useful in the sulphite mills. First of all, there are the brick, tile, and cement linings that are so carefully utilized in the towers, tanks, and digesters. Without these protective coatings, it would be almost impossible to get any life out of the particular pieces of equipment that are used. With an acid process, lead linings come into their proper place and are needed in tankage, as well as lead pipe to convey the liquid or other materials from one tank to another.

The next important material pertains to the rubber linings. They have come into being within the last few years because of the advance of synthetic rubber and the ability to use it under the many conditions that it is helpful to apply it. A few years back it was almost impossible to get any life out of natural rubber at the higher temperatures or in the places where oil and other materials easily attack it. Neoprene rubber has the qualities to resist these things and has proved to be a very helpful ally in combating the corrosion that would be so destructive to all of the materials that have to be used in processing the pulp and its conversion into paper.

The last 10 years has seen such a tremendous advancement in the use of the plastic coatings that they are almost too numerous to mention. In order to avoid calling them by their specific trade names, they shall simply be called the plastic variety of coatings. However, most are familiar with their many uses and their abilities to withstand various chemicals. One of the leading rubber companies has recently come out with a plastic-type pipe that is hard enough to be threaded and used with screwed fittings and still retain all of the finer properties of the original plastic material. They have even gone so far as to build valves, as well as the other fittings, of this material for those who have to handle extremely corrosive materials like alum solutions, acid solutions that are reasonably concentrated, and the many solutions that are very difficult to handle.

In this same category the phenol resin compounds that have been developed within the last few years must be mentioned. They do have their limitations in that they are rather difficult to apply to large tanks and large pipe fittings or other materials of a like nature simply because they require many coats with air drying or heat drying. A great deal of time is required for air drying. The baking process or heat drying requires large amounts of heated air in order to properly apply these compounds. Just in the last 2 or 3 years the Saran-type coatings have made quite a few advances with various materials that can be applied and air dried. These processes give tanks the ability to withstand the corrosive action of many of the liquids encountered in the handling of the sulphite pulp.

George R. Lydick, Plant Engineer, The Beckett Paper Co., Hamilton, Ohio.

The next material that should be mentioned, and the on with which you are probably more familiar than those me tioned above, would be the various ranges of stainless ste Its use in tanks, tankage, tubing, and piping has played tremendously important part in the increased productio in the sulphite industry for the past few years. The poss bilities of stainless steel have only begun to be explored b cause of its many wide varieties and ranges. Naturally, co enters into the picture and stainless steel is still in the almo prohibitive range in many of the classifications, but as indu trial know-how progresses stainless steel will become mo readily available at much more reasonable prices. Perha some have utilized monel for some of the same applicatio that stainless steel has been used. Monel seems to posse many qualities that are much more desirable than many the ranges of stainless steel, and certainly its use will becom more and more satisfactory for the various applications whe extremely corrosive conditions are encountered. This simply because it has greater possibilities of fabrication an resistance to corrosion than some of the classifications stainless.

The last breakdown of the points to be considered in th sulphite mill usage should certainly include rubber hose as substitute for piping. There are many applications of rubb hoses and tubing that can be considered. The rubber hos being considered are the 4, 6, 8, 10, and 12-in. diameter hos that can be utilized in many places where corrosion not on causes a great deal of difficulty, but also where such things settling of solids in the liquid to be handled build up in t pipe and eventually cause failure of the pipe conducto The advantage of rubber hose in these applications is that it possible to flex it several times and break these materials loo and keep the hose in a reasonably good operating conditio The special applications of rubber hoses in these ranges, course, include the very simple pinch-type valves and speci flanged fittings and connectors that are very desirable f handling the extremely corrosive liquids encountered in t sulphite mill.

The more specific applications of the items mentioned abo will be discussed in greater detail as soon as some of th materials that are used in the kraft or soda process mill a covered.

The next major breakdown of items to be discussed pertai to the kraft or soda process mill. First under this particul process could certainly be included the use of brick tile ar special cement linings—the same as mentioned above und the sulphite mills. The big difference that must be bor in mind is the use of this special cement and its ability to resi the salt cake and black liquor that are so highly corrosive the conventional types of cements. By utilizing this speci cement, which to the author's knowledge is obtainable on from the West Coast, it is possible to pour floors or po lining inside of tanks that are practically inert to the high corrosive conditions encountered where the black liquor ar salt cake are able to get at these materials and wreck so muc havoc. The addition of this same material to mortar f binding brick together gives it the same resistance to corrosi and certainly seems to be a very desirable means of combati serious corrosion problems encountered in the kraft or so process mill. Those who have had any experience with th type of mortar or cement will certainly recognize its superi value to that of the conventional types. First because of i quick setting capabilities and second because of its extre hardness. Conventional cement of an extremely goo quality will seldom run over 4000 p.s.i., whereas ceme treated with this process will run many times from 5000 6000 p.s.i. in compression.

As mentioned before, in the sulphite mill usage of stainle steel naturally plays a very important part in the operati of a mill of kraft and soda process variety. Stainless ste tanks, tankage, and piping must be utilized to a considerab

extent. In the handling of the various liquors that are used for cooking the chips in order to produce pulp this is particularly important. Without the tremendous advantage that stainless steel plays over and above the common grades of steel, it would be almost impossible to keep the kraft or soda process mill running any great length of time. While discussing stainless steel for the kraft mill, the fact that monel is becoming more and more recognized as a very fine ally in the fight against corrosion should be mentioned. It is always wise to mention the fact that the cost can be reduced by utilization of stainless clad or monel clad for the tanks.

The next item in the kraft or soda process mill, of course, should certainly include the phenol resin compounds in the wide variety of usage that they can given. Next would be mastic coatings that are permissible to use in the kraft or soda process mills. Perhaps some have had experience with them, but it should be pointed out that great possibilities exist in the use of these particular coatings, especially where the thick build-up coating is desired. Steel tanks, steel pipes, or cylinder vats that are to be coated with these particular materials have to be properly prepared, but with the use of Fiberglas membranes it is possible to build a fairly thick coating that will last many years under extreme corrosive conditions.

Last, but not least, in the list of materials for the kraft or soda process mill should be mentioned the use of asbestos and cement pipe and the various combinations that are now utilized or are available on the market. Now that the various materials that are available have been covered and mention has been made of the points where they might be utilized, it would be well to go a little deeper into the specific application of the noncorrosive materials.

Item 1 is tanks and vats. In this category the use of phenol resin compounds will be discussed first. Most of them are easily applied, but the preparation of the material for the interior of the tanks requires sand blasting almost exclusively. This is probably one of the biggest drawbacks to the use of the phenol resin compounds, because sand blasting equipment sometimes is not available and, second, the tanks may not be of sufficient size for someone to get inside of them and prepare them in this manner. The spray painting, of course, offers little in the way of an obstacle, but the drying of the compound in order to acquire the proper thickness of coat and to have it cured properly requires heat. This again is not always possible, especially when the tank is of such size that it is not easily enclosed or if it is not possible to properly seal it off and circulate high temperature air. In order to acquire any great thickness of the material many coats are required and this runs into prohibitive costs. It might be mentioned in passing though, that from the uses the author has encountered with this particular range of materials he has found it extremely satisfactory in its resistance to corrosion. One particular application in a kraft mill where it seemed to be a very superior way is in coating the interior of peculiar castings utilized in the piping and flow arrangement to the headbox. This has held up extremely well, and certainly was a good saver because if stainless steel or some of the other noncorrosive metals had been used, the cost would have been prohibitive.

For item 2, the use of the clad-type of steel whereby a thin layer of the stainless variety is fastened to the steel giving a 10 or 20% or even a 30% clad steel plate might be mentioned a little more specifically. This has the advantage in giving one side an extreme resistance to corrosion. It cuts down the cost and, of course, has the big advantage of having the original strength of a mild steel plate.

Item 3 is the lining of tanks with a thin sheet of stainless steel, or monel, or copper, or even tin. It is understood that some tests have been made with thin aluminum sheets. The biggest disadvantage to this particular method is the fact that extreme care must be utilized in fastening the linings. Otherwise, leakage behind the linings can cause as much havoc as if the lining was not installed.

Item 4 is the use of rubber and the synthetic products that go along with it. Again unusual care must be utilized in preparing the interior of the tanks, such as sand blasting or some method that would give an extremely clean surface. Then if the tank is small enough, it can be dipped into the solution—or if it is so large that this is not practical then, of course, the rubber solution has to be sprayed on. Again the factor of curing the coating or baking it under fairly high temperature plays an important part.

Item 5—tanks made out of stainless sheet, copper sheet, etc., of course, make the best possible vessel that can be had. However, the cost is usually prohibitive with these applications and there are certain problems in the welding of fastening the plates and sheets together.

Item 6 pertains to the use of cement sheet or transite sheets, or chemstone sheets as they are sometimes called in the industry. Certainly the author would be negligent if he did not mention the use of these sheets in the various tanks because they do offer tremendous possibilities provided they are properly put together and properly protected at the joints. You certainly are familiar with the inert qualities of sheets of this type and their possibilities. Perhaps the biggest factor that prevents many people from using them is the fact that they are rather difficult to assemble properly in order to have the necessary conditions of a tank. However, if they are properly assembled, no better corrosionproof material can be had because of the inert properties of the material in them.

The next item pertains to the use of pipe or conductors. Most certainly are familiar with the use of stainless steel tubing, copper tubing, or aluminum tubing, and lead pipes in the various mills, and the author is merely going to mention the fact that they are available. There is a tremendous advantage that can be had by utilizing these materials in piping as against the conventional type pipes where corrosive conditions are encountered. With the utilization of stainless steel tubing there are many ways they can be fastened together quickly. In the author's mill a great deal of stainless steel is being used because of the ease with which it can be assembled. All joints are of the Vanstone flanged type and, of course, the tremendous saving that these joints offer need not be pointed out. Alignment is not difficult with this method of connecting the pipe, and by utilizing the heliarc welding process it is possible to make joints on any given length of tubing. The steel back-up flanges are even made the plant shop. Copper tubing can be utilized in the same manner. That is, hard drawn copper tubing can be annealed on the ends and Vanstone flanges turned. Certainly all are familiar with the ease with which the sweat joints can be applied to copper tubing whereby the pipefitter needs only a blowtorch, soldering acid, and some solder to connect the joints.

Aluminum pipe has its limitations, but certainly it will bear further investigation to determine what advantages it has, if any, over some of the other noncorrosive materials that have been mentioned. Naturally lead pipe plays a tremendous and important part in the paper mills because of its ability to withstand corrosion where acids are handled. Lead has long been used in this manner, and little more need be said about its great ability to withstand corrosion.

Cement asbestos pipe is coming to the foreground because of the many advantages that it has over and above some of the other materials. We utilize it in our mill, and the author has been associated with other mills that have used it to very fine advantage. After proper instruction has been given to the pipefitters, it is just as easy to handle as any cast iron pipe. Certainly it is comparable in cost, and its tremendous advantage over other types of materials is the fact that it is inert to practically all of the materials that are handled through it. The longer it is used the better it appears to withstand wear. The interior becomes more nearly polished and it can be understood what this would do to the flow

characteristics. Along with the cement asbestos pipe the tremendous strides have been made in the last few years on fittings—in tees, elbows, and odd shape fittings—that can be made with it. Fittings are steel jacketed but the interiors are so fastened together that they are just as satisfactory as if they were solid asbestos cement.

As to cast iron and its uses—of course, there is a great deal of corrosion with most any of the cast iron fittings or pipe that are used. The point that should be made in the use of cast iron is that with the combination of interior coating a very desirable corrosion-resistant material is had. Since the method of applying the phenol resin compounds with them has already been mentioned, it is believed you can understand that we have a unit which would have tremendous strength.

Many of the mills use a great deal of wood-lined pipe and its advantages, of course, are the fact that it can withstand corrosion for long, long periods. Of course, the wetted wood is extremely slick and offers a very good flow characteristics.

The last item pertains to the use of hard rubber for piping and the range of plastic materials must be included along with it. These are very valuable materials to conduct the highly corrosive range of liquids. Specific reference is made to the handling of the chlorine from the chlorinators to tanks or pits where it is necessary to inject periodic dosages, or continuous dosages, of this highly corrosive material.

The author would like to point out just a few of the tremendous advantages that can be obtained now as against the fittings that were obtainable only a few years ago. First are the valves—it is now possible to obtain stainless steel valves at much more reasonable prices than formerly. This offers tremendous advantages to the paper mills by being able to have such a good alloy to use. Cement asbestos fittings are available now, and in the last few months cement asbestos valves have made their appearance. While the author has not seen any of them, he is sure that the same fine characteristics that apply to the cement and asbestos pipe would apply to the valves. Naturally, bronze and brass valves have been used for so long that they are taken for granted, but certainly they should be mentioned as a valuable ally in the fight against corrosion. The rubber-lined variety of valves and the plastic variety of valves that are available on the market should also be mentioned. Each manufacturer has a special range of linings for the particular application, and if his recommendations are carefully followed, fine service will be obtained where highly corrosive conditions are encountered.

One of the biggest advantages of the rubber pinch-type valve that is more or less being introduced to the paper industry but has been on the market for many years, is the fact that the flow characteristics of this valve are more nearly perfect. By that is meant that as the valve is gradually pinched down to throttle it, the throttling effect is much more uniform than with the conventional gate valve. Naturally, in handling stock it is always possible to obtain a plug ahead of a valve which in turn will eventually cause complete stoppage. The big advantage with this pinch valve is that it can be opened up and allowed to clear itself, and then go back to the original clamping or closing down on the valve. Before leaving the item of valves, the fact that it is possible to obtain the fabricated stainless valves at a considerable saving over the cast body valve of the same material should be pointed out. This represents a tremendous saving.

As previously mentioned, it is possible to obtain the special cement that has the inherent ability to withstand the ravages of black liquor, salt cake, and alkali compounds for buildings, floors, walls, and the portions of them that come in contact with the corrosive conditions around the paper mill.

We know that the asphalt base makes most of the asphalt mastics practically inert to most of the corrosive conditions encountered, and this gives the maintenance man a material that he can use to correct some of the conditions that would otherwise quickly ruin the floors or walls.

A great deal of ground showing the utilization of t various materials and how they are applied to many of t items in the paper mill has been covered, but the applic tions of these materials to the specific pieces of equipment th are used in the paper mill has not been thoroughly covere It is known that it is possible, if necessary, to have a stainle steel casing pump, stainless steel impeller and shaft in orc to combat the corrosive conditions of the material to be ha dled. It is possible to have the interior of the pump coat with the rubber or saran linings, and have the impeller treat in the same manner in order to properly protect the pump.

Fans, of course, that have to handle gases that are high content of SO_2 gases and so on, have to be properly protect or they would last practically no time. Usually rubb linings can be very satisfactorily applied to the blading order to protect them. It is always possible to go to so other material that would satisfactorily withstand the ravag of the gases, or the acids contained in them, but generally is cheaper to use the lining method.

We are familiar with the use of stainless steel around fourdrinier, and the other noncorrosive materials—such monel, brass, etc.—that are utilized in order to combat t corrosion at this point. Tremendous steps have been tak in the last few years in the use of stainless steel for all of t supporting rails, saveall pans, and the allied parts that usua waste away very quickly unless they are thoroughly protecte

In the press section, there are brass or rubber-covered ro and stainless steel saveall pans. So much has happened in t last few years in bringing about fabrication of parts that u lize the noncorrosive materials that our thinking is almo entirely geared to this.

In certain installations clad or plated driers have be utilized in order to combat extreme corrosive conditions, a the chrome-plated riers are sometimes used in very spec processes.

In discussing savealls, the same old problem of handling t corrosive liquids must be recognized. The vats either ha to be lined and the drums made out of nonferrous mate or corrosion soon makes a great inroad on the life of th particular pieces of equipment.

Naturally, all are aware of the tremendous amount research that is going on at the present time to determine w is happening to the digesters, especially in the kraft indust There is little need to do more than point out the fact that t digesters certainly have to be protected and, as mention earlier, the digesters in the sulphite mill certainly are pr tected with the tile linings and other agents. In the kra industry a great deal of thought and research is being giv to the stainless clad digesters, as well as to the special all lined digester, in order to increase their life.

In summarizing, let us re-emphasize that the growing use stainless, and monel, and other nonferrous metals have beer very valuable aid to the papermakers and operators of t mills because of their tremendous ability to withstand co rosion. The gains in the use of cement asbestos pipe a asbestos sheets lead us to believe that tremendous possibiliti exist for the use of these materials. Certainly they must carefully considered in all that a mill operator does in ord to combat corrosion. The increased usage in special ceme mortars, asphalts, mastics, etc., has certainly given t operators and maintenance men some very valuable materi to use to combat corrosive conditions. The plastic family a rubber coatings have made great postwar development What the future holds for them is almost impossible to predi but they are certainly playing an increasingly important pa in thinking of the mill operators because of the tremendo advantages they seem to have.

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Sealing Strength of Paraffin Wax*

TAPPI Suggested Method T 642 sm-54

(THIS SUGGESTED METHOD IS UNDER THE JURISDICTION OF THE WAX TESTING COMMITTEE)

THIS method is intended to measure the sealing strength of paraffin wax when tested on a standard paper specimen under standard conditions of temperature and humidity and under defined conditions of preparation and sealing of the test specimen.

APPARATUS

1. Equipment for preparing a waxed paper web 5 inches wide by saturating a web of the standard paper with paraffin wax and applying a surface wax of 3.5 ± 0.5 pounds per ream (24 × 36—500) on the uncoated base-paper side (the side to be sealed). A Meyer coater or a squeeze-roll coater is suitable.

2. A power-driven sealing machine as shown in Fig. 1 which will seal the 5-inch wide web at a sealing

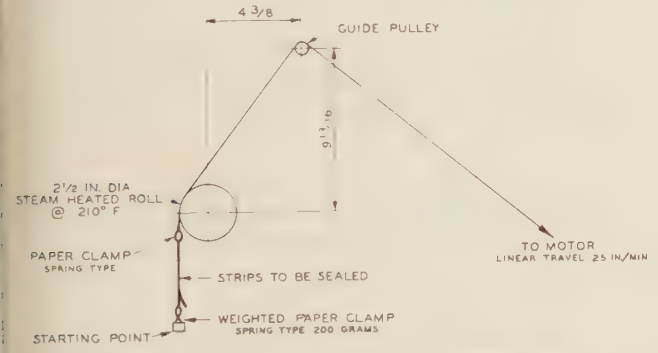

Fig. 1 Schematic diagram of Palo Myers-type sealer

rate of 25 inches per minute at a temperature of 205 to 210°F., at an angle of approximately 60° as specified in the design of the Palo Myers sealer, and under a constant weight of 200 grams.

3. A power-driven tensile testing machine which will measure the force in grams necessary to separate a specimen consisting of two sealed plies of paper 3 inches wide, and which is sensitive to 1% of the minimum load applied.

The rate of separation of the jaws or clamps shall be 5 inches per minute, which gives a uniform separation rate of the seal of 2.5 inches per minute throughout the test.

The clamps or jaws shall be so located that the test specimen shall be separated in the same plane, at an angle of 180°, with the unseparated portion at right angles to this plane.

MATERIALS

The standard paper for waxing shall be a regular commercial 24.5 to 25.5-pound (24 × 36—500) coated sulphite breadwrapper, which is a sulphite sheet clay-coated on one side, about 0.0017 inch thick and with an apparent density of about 0.95 gram per cc.

Waxing

The roll of standard paper shall be conditioned in accordance with TAPPI Standard T 402 m for at least 1 week prior to coating with wax. The uncoated side of the base paper shall be waxed for testing purposes. Prepare the waxed sample by means of the coater, so that it is saturated and has 3.5 ± 0.5 pounds of surface wax per ream on the side of the sheet to be sealed. Determine the quantity of wax on the surface by weighing a sample of the waxed paper 4 by 4 inches, removing the surface wax by scraping with a single-edged razor blade until a few paper fibers come off with the wax, and reweighing the paper sample. The loss in weight in grams multiplied by 59.5 gives pounds of wax per ream (24 × 36—500).

Preparing Sealed Specimen

Fasten two waxed samples, 5 inches wide, in the jaws of the sealing machine with the wax-coated surfaces against each other. Then attach the 200-gram weighted clamp to the bottom of the outside sheet, which is the sheet furtherest from the heated cylinder. (*See* Fig. 1.) Adjust the temperature of the heated cylinder between 205° and 210°F. Start the motor and pull the two sheets over the heated cylinder at the rate of 25 inches per minute. Shut the motor off just as the weighted clamp is about to pass over the heated cylinder. Let the sealed sample remain untouched, at room temperature, for the next 15 seconds while the paraffin solidifies; then remove the sealed sample web from the machine.

TEST SPECIMEN

Cut at least 10 test specimens 3 inches wide from the

* This method is suggested by the Standards Committee as being the most suitable to date. It is *not*, however, a TAPPI Standard. Criticisms are earnestly requested and should be sent to R. G. Macdonald, Secretary, Technical Association of the Pulp and Paper Industry, 155 E. 44th St., New York 17, N. Y.

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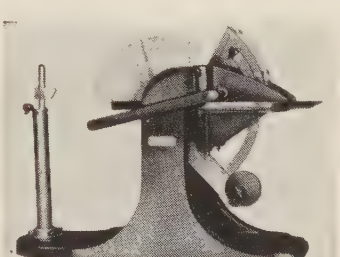

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sealed sample web, allowing a 1-inch trim on each ed of the specimen. This trim is necessary to elimina any beads or other irregularities which generally oc on the edges of the sealed sheets. The length of t test specimen shall not be less than 6 inches, but m be longer if desired. Figure 2 shows how the test spe

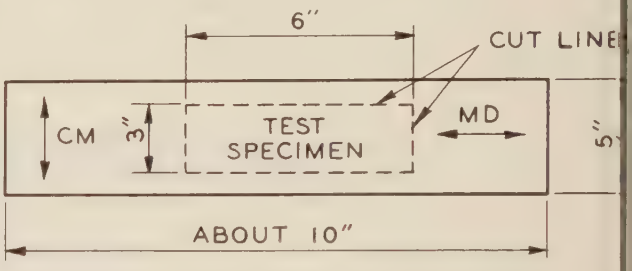

Fig. 2. Test specimen cutting details

Note: CM = Cross Machine. M.D. = Machine Directi

men is cut from the sealed sheets. The test specime shall be conditioned in accordance with TAPPI Sta ard T 402 m for 24 hours before testing.

PROCEDURE

Separate manually the two plies along the first in of a test specimen and clamp the ends of each ply in t jaws of the testing machine, taking care that they a properly aligned. Start the testing machine a separate the plies so that the ends being separated a in the same plane, at an angle of 180°, and with t unseparated portion at right angles to this pla Start the machine and, at intervals of 10 seconds more, take five readings of the grams of force requi to continue the separation of the sealed plies. D card the results from any specimen whose test result due to some obvious flaw, and make another test.

Average the five accepted readings for each specim and divide this average by 3 to give the force in gra per inch width.

REPORT

Report the average of the results obtained on the test specimens at the sealing strength of the wax in gra per inch.

ADDITIONAL INFORMATION

The Wax Testing Committee considers it advisab that a method for sealing strength be presented at on so that a start can be made in standardizing t methods used in various laboratories. This method proposed by the committee as being the most suitab to date, after an examination of the existing metho and procedures and from preliminary round-robin tes Effort has been made to keep it as simple as possib for ease of duplicating the procedure without confini the test to any one test instrument. It is also believ desirable that certain points, such as angle of sepa tion of the sealed specimen and effect of slow or qui chilling of the seal in the sealing operation, should investigated in further round-robin tests before t method is finally standardized. Although the precisi of the method leaves considerable to be desired, it probably sufficient to distinguish significant differen in waxes.

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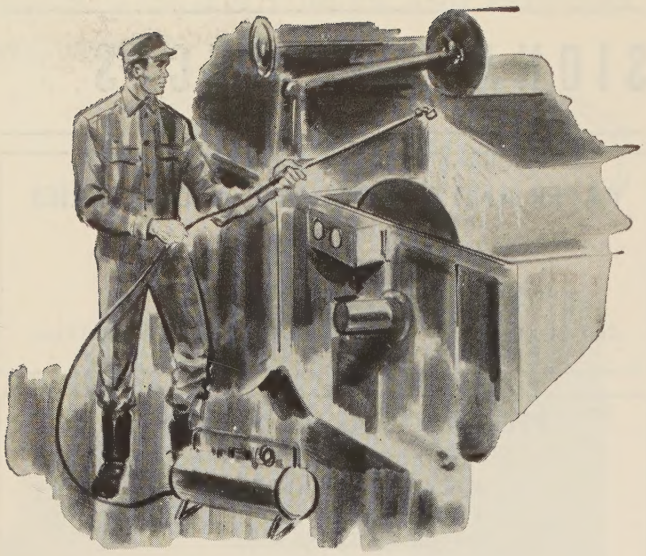

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Du Pont de Nemours & Co., Inc., E. I. (Dyestuffs)	2 A
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Fawick Airflex Div. (Federal Fawick Corp.)	41 A
Foxboro Co.	30 A
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Hercules Powder Co.	2nd Cover
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Hillside Laboratory	166 A
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Hubinger Co., The	56 A
Hygrotester, Inc.	101 A
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International Nickel Co., Inc. The	34 A
Johns-Manville Corp. (Celite)	4 A
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Kelco Co., The	27 A
Lobdell United Co.	28 A
Magnus Chemical Co.	168 A
Mallinckrodt Chemical Works	102 A
Mathieson Chemical Corp.	43 A
Midwest-Fulton Machine Co.	105 A
Mixing Equipment Co., Inc.	59 A
Monsanto Chemical Co. (Organic Chemicals)	13 A
National Forge & Ordnance Co.	104 A
Nopco Chemical Co.	54 A
Norton Co.	58 A
Pandia, Inc.	87 A
Penick & Ford Inc.	60 A
Pusey & Jones Corp.	51 A
Reichhold Chemicals, Inc.	39 A
Reliance Electric & Engineering Co.	15 A
Rice Barton Corp.	57 A
Riegel Paper Corp.	36 A
Rohm & Haas Co.	3rd Cover
Roots-Connersville Blower (Div. of Dresser Industries, Inc.)	61 A
Sandy Hill Iron & Brass Works	79 A
Shuler & Benninghofen	64 A
Socony-Vacuum Oil Co.	23 A
Solvay Process Div. (Allied Chem. & Dye Corp.)	62 A
Staley Mfg. Co., A. E.	49 A
Stebbins Engineering & Mfg. Co.	81 A
Testing Machines, Inc.	166 A
Torrington Co., The (Bantam Bearings Div.)	70 A
Tyler Co., W. S.	99 A
Union Screen Plate Co. of Canada Ltd.	93 A
Vanderbilt Co., R. T.	11 A
Waldron Corp, John	33 A
Wallace & Tiernan Co., Inc.	66 A
Wallerstein Co., Inc.	102 A
Weyerhaeuser Timber Co. (Pulp Div.)	72 A

PROFESSIONAL SERVICES

The H. K. Ferguson Co.	167 A
G. D. Jenssen Co., Inc.	167 A
Hildegarde P. Kipp	167 A
Alvin H. Johnson & Co., Inc.	167 A
Knowles Associates	167 A
Chas. T. Main, Inc.	167 A
Roderick O'Donoghue	167 A
Paper and Pulp Testing Laboratories	167 A
Pfeifer & Shultz	167 A
Sandwell and Company	167 A
Seelye Stevenson Value & Knecht	167 A
J. E. Sirrine Co.	167 A

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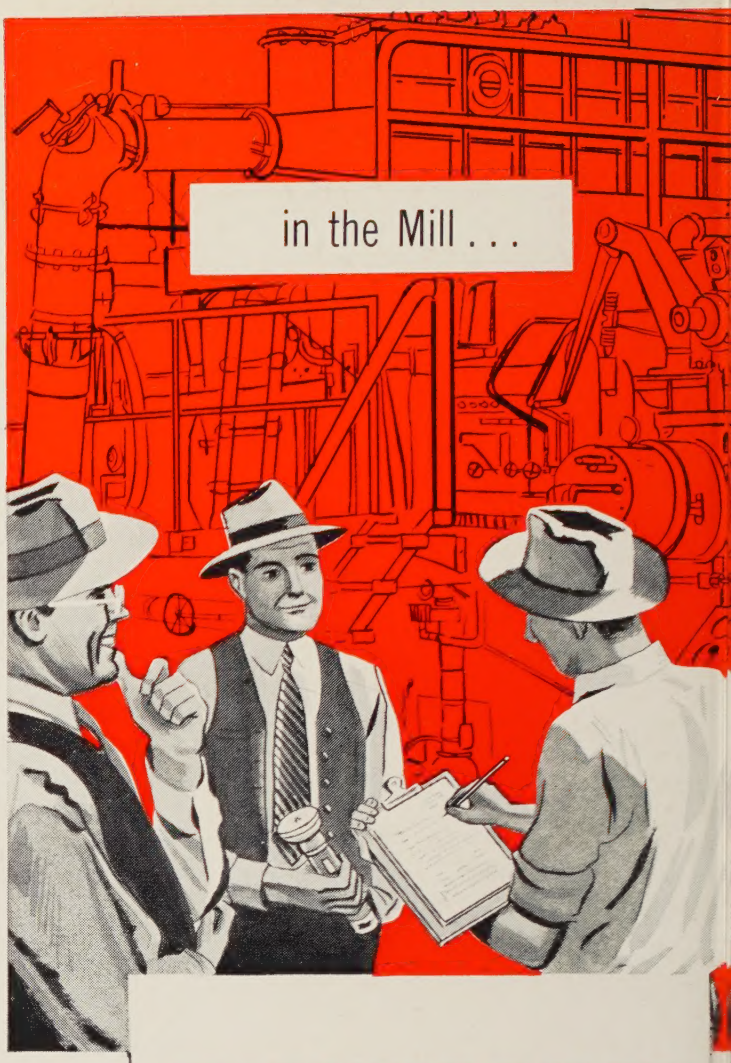

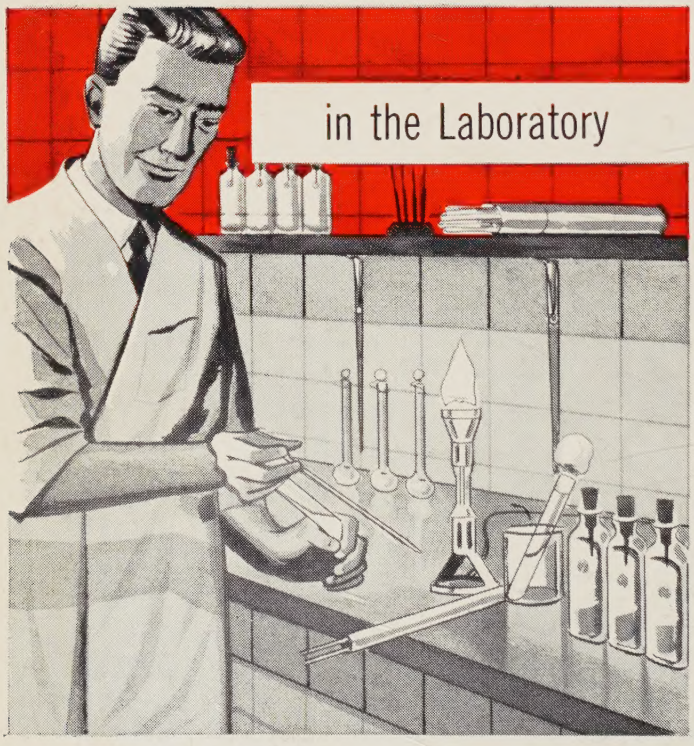

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